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Sugar et al.

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(54) **METHODS AND SYSTEMS RELATED TO AUDIO DATA PROCESSING TO PROVIDE KEY PHRASE NOTIFICATION AND POTENTIAL COST ASSOCIATED WITH THE KEY PHRASE**

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Related U.S. Application Data

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(51) **Int. Cl.**

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G10L 15/04	(2013.01)
G10L 15/10	(2006.01)
G10L 15/08	(2006.01)

(52) **U.S. Cl.**
CPC ***G10L 15/10*** (2013.01); ***G10L 15/00*** (2013.01); ***G10L 15/08*** (2013.01)

(58) **Field of Classification Search**
CPC G06F 17/2785; G10L 15/00; G10L 15/265
USPC 704/251
See application file for complete search history.

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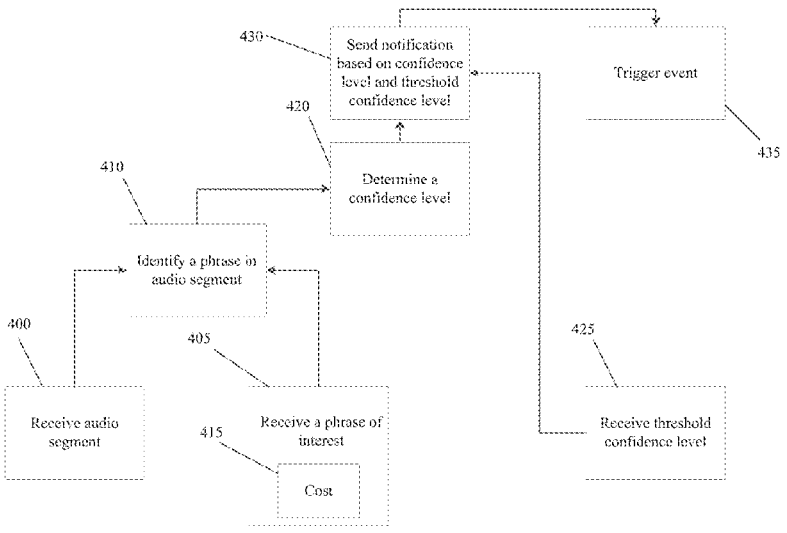
(57) **ABSTRACT**

Methods and systems related to analyzing audio data and performing quantitative analysis and reporting related to the audio data. Audio data may be investigated and phrases of the audio data identified. In some implementations, phrases are identified based on the likelihood of an occurrence or non-occurrence of the phrase. In some implementations, phrases are identified based on a cost associated with a search phrase.

22 Claims, 18 Drawing Sheets



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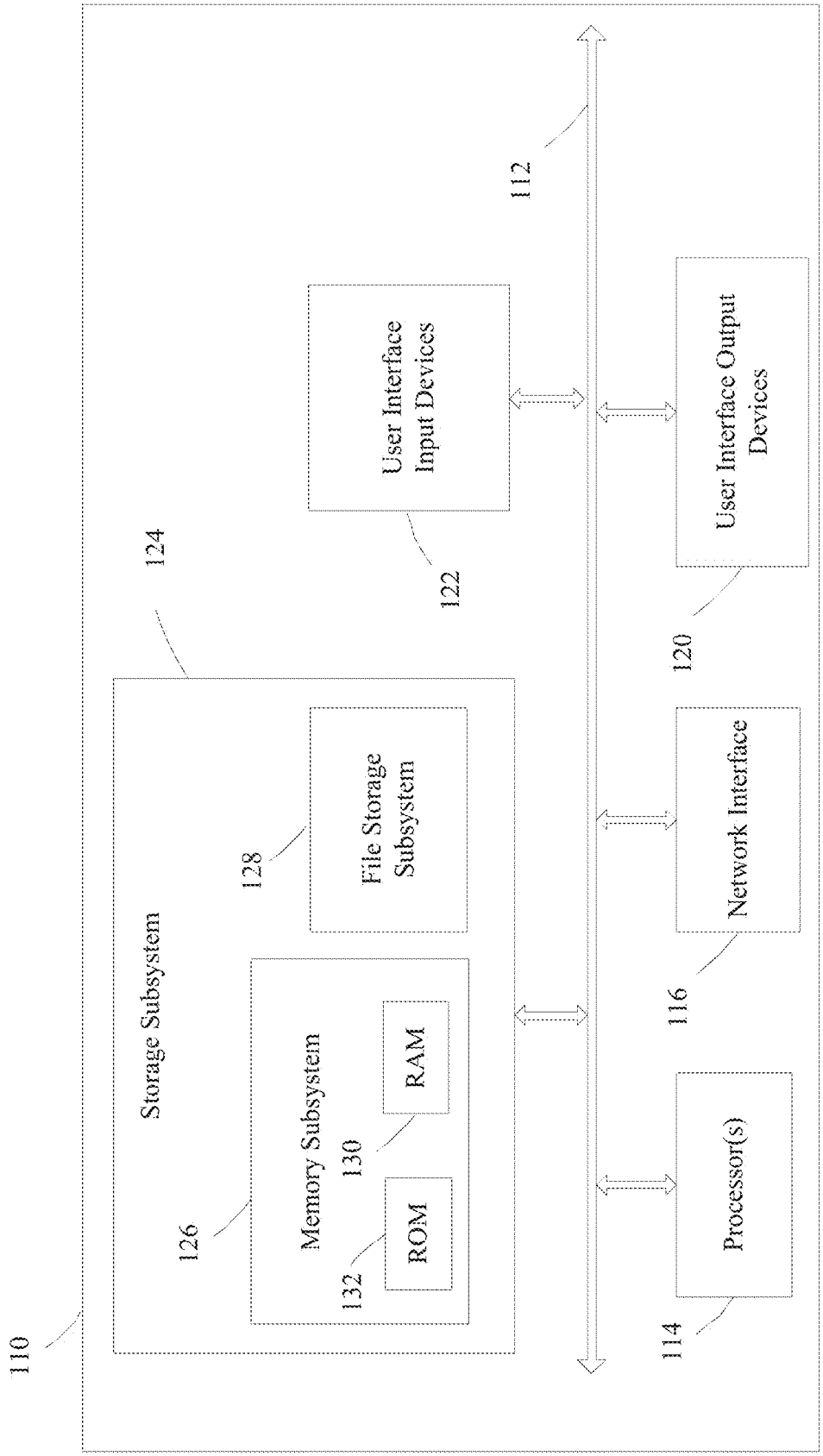
110
Storage Subsystem
124
126
Memory Subsystem
130
RAM
132
ROM
128
File Storage Subsystem
User Interface Input Devices
122
112
User Interface Output Devices
120
Network Interface
116
Processor(s)
114

FIG. 1

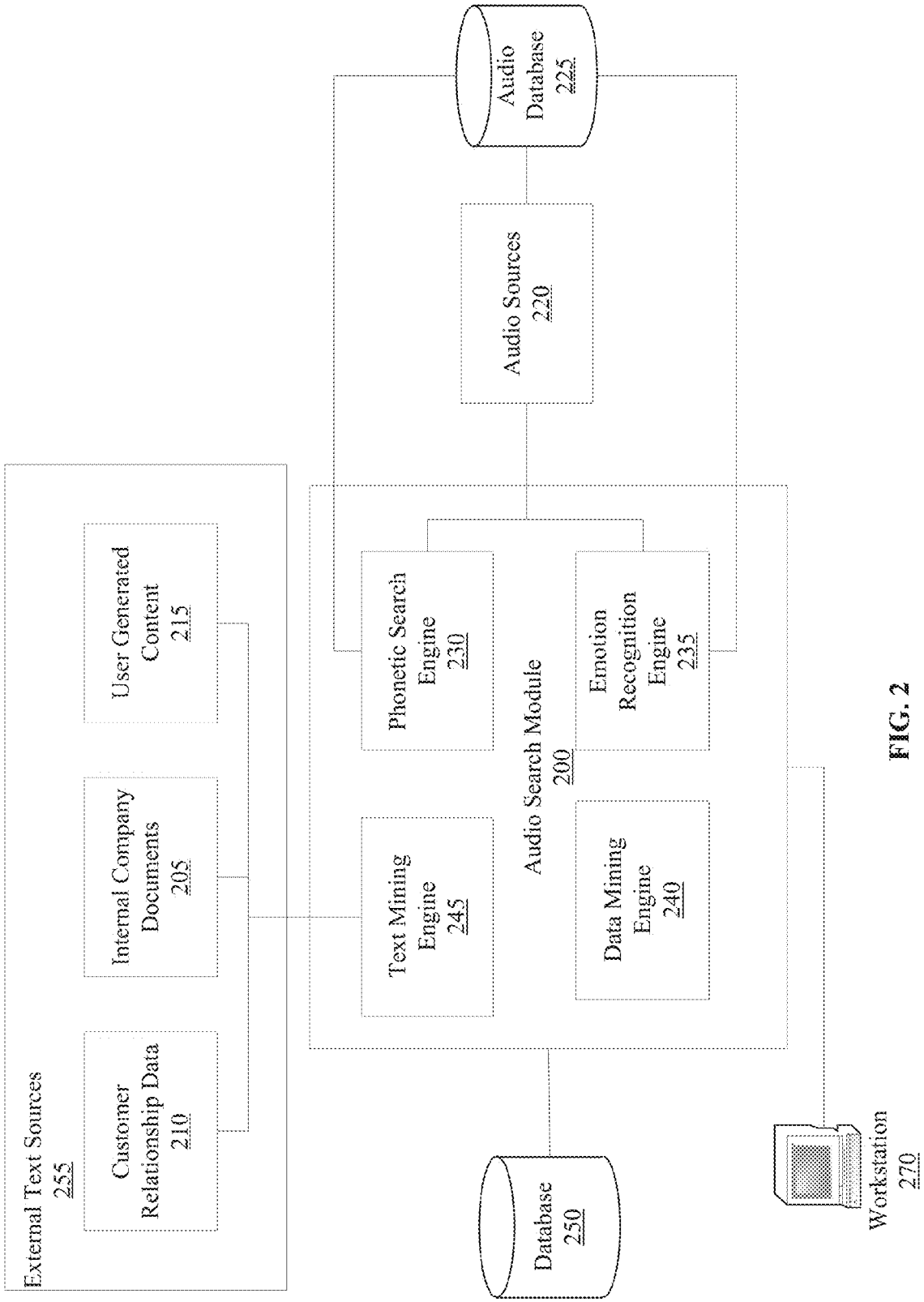
External Text Sources
255
Customer Relationship Data
210
Internal Company Documents
205
User Generated Content
215
Audio Search Module
200
Text Mining Engine
245
Phonetic Search Engine
230
Data Mining Engine
240
Emotion Recognition Engine
235
Audio Sources
220
Audio Database
225
Database
250
Workstation
270

FIG. 2

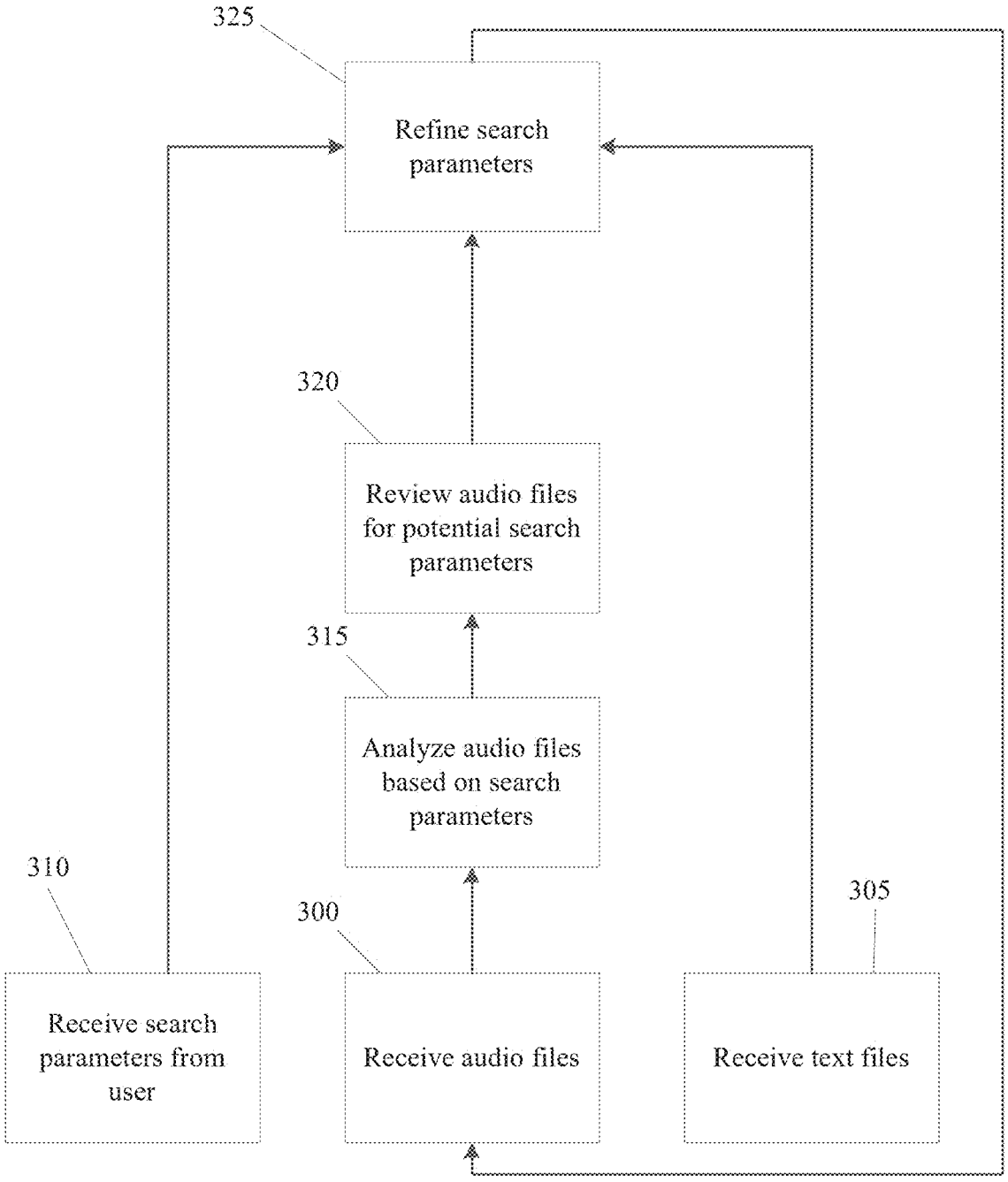
325
Refine search parameters
320
Review audio files for potential search parameters
315
Analyze audio files based on search parameters
310
300
305
Receive search parameters from user
Receive audio files
Receive text files

FIG. 3

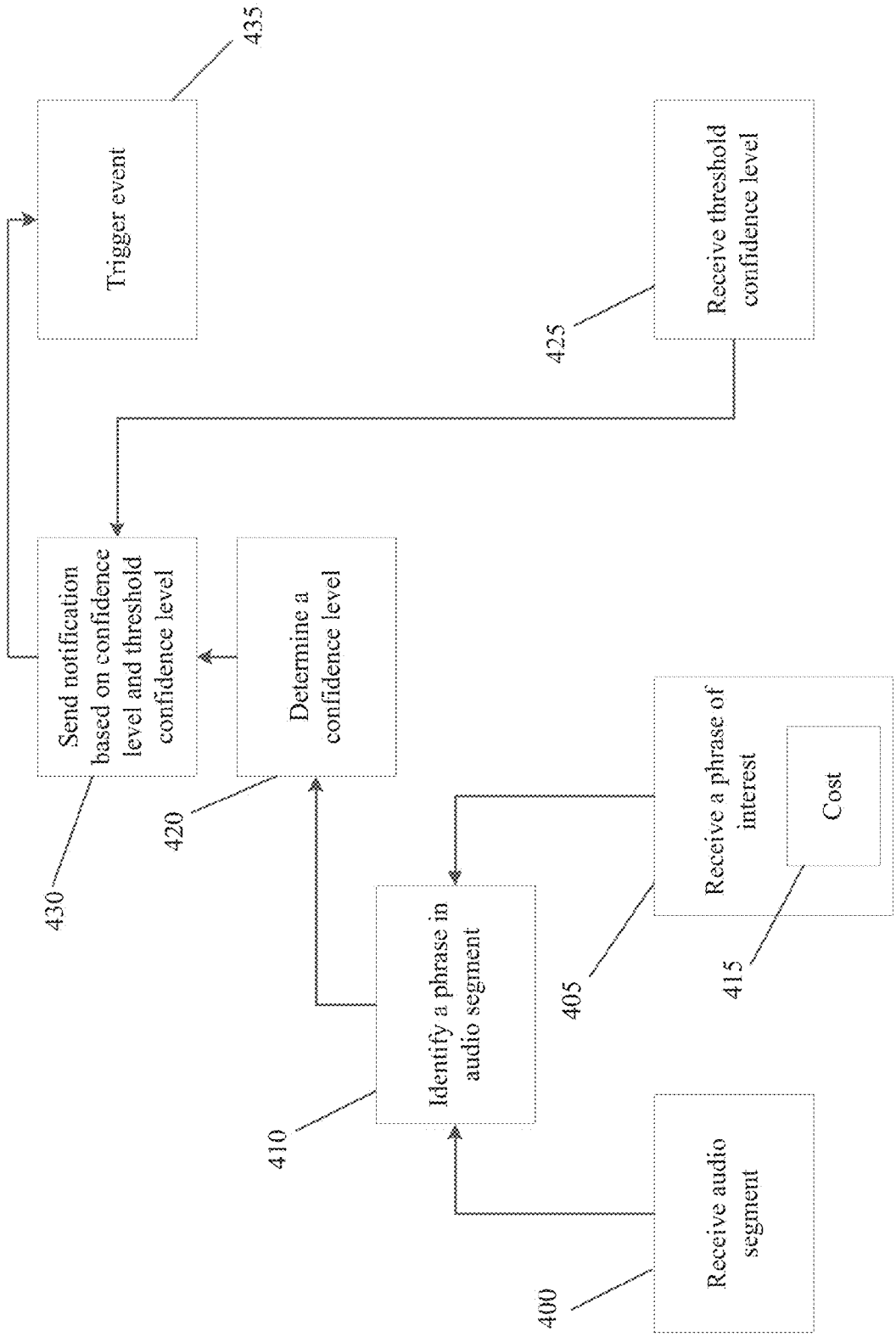
Receive audio segment
400
Identify a phrase in audio segment
410
Receive a phrase of interest
Cost
405
415
Determine a confidence level
420
Send notification based on confidence level and threshold confidence level
430
Receive threshold confidence level
425
Trigger event
435

FIG. 4

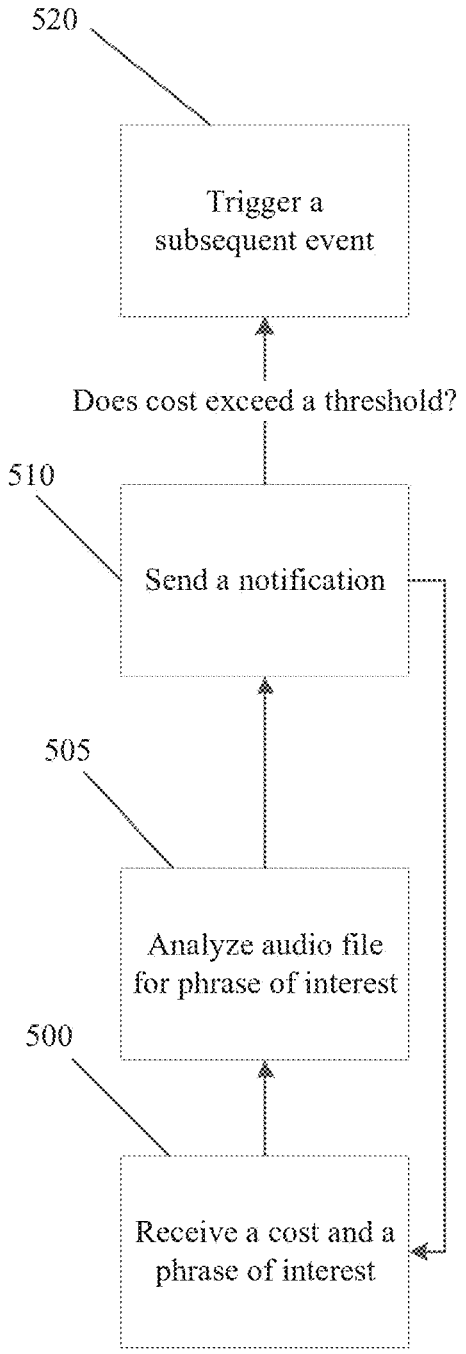
520
Trigger a subsequent event
Does cost exceed a threshold?
510
Send a notification
505
Analyze audio file for phrase of interest
500
Receive a cost and a phrase of interest

FIG. 5

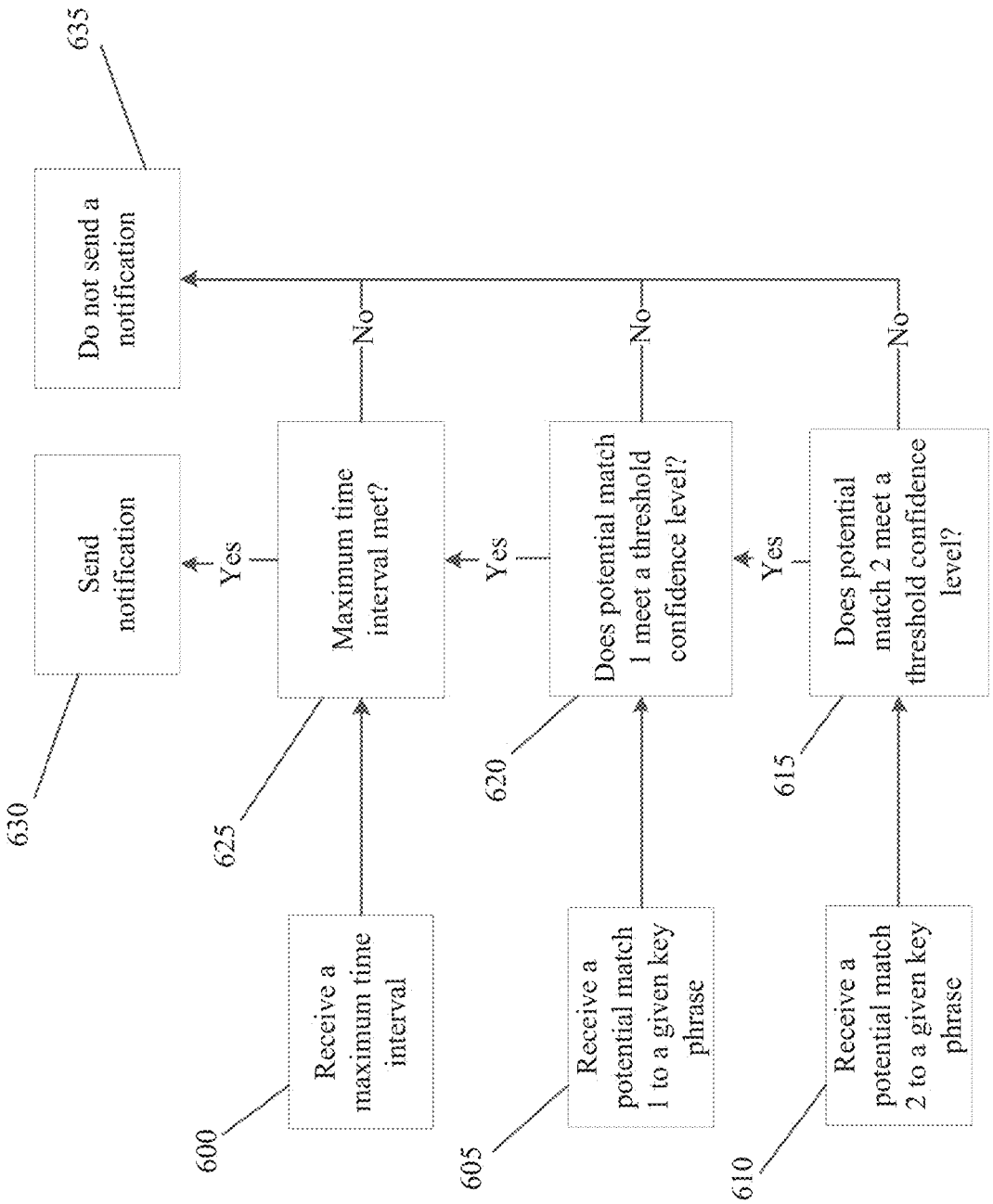
Receive a maximum time interval
Receive a potential match 1 to a given key phrase
Receive a potential match 2 to a given key phrase
Maximum time interval met?
Does potential match 1 meet a threshold confidence level?
Does potential match 2 meet a threshold confidence level?
Yes
Yes
Yes
No
No
No
Send notification
Do not send a notification
600
605
610
625
620
615
630
635

FIG. 6

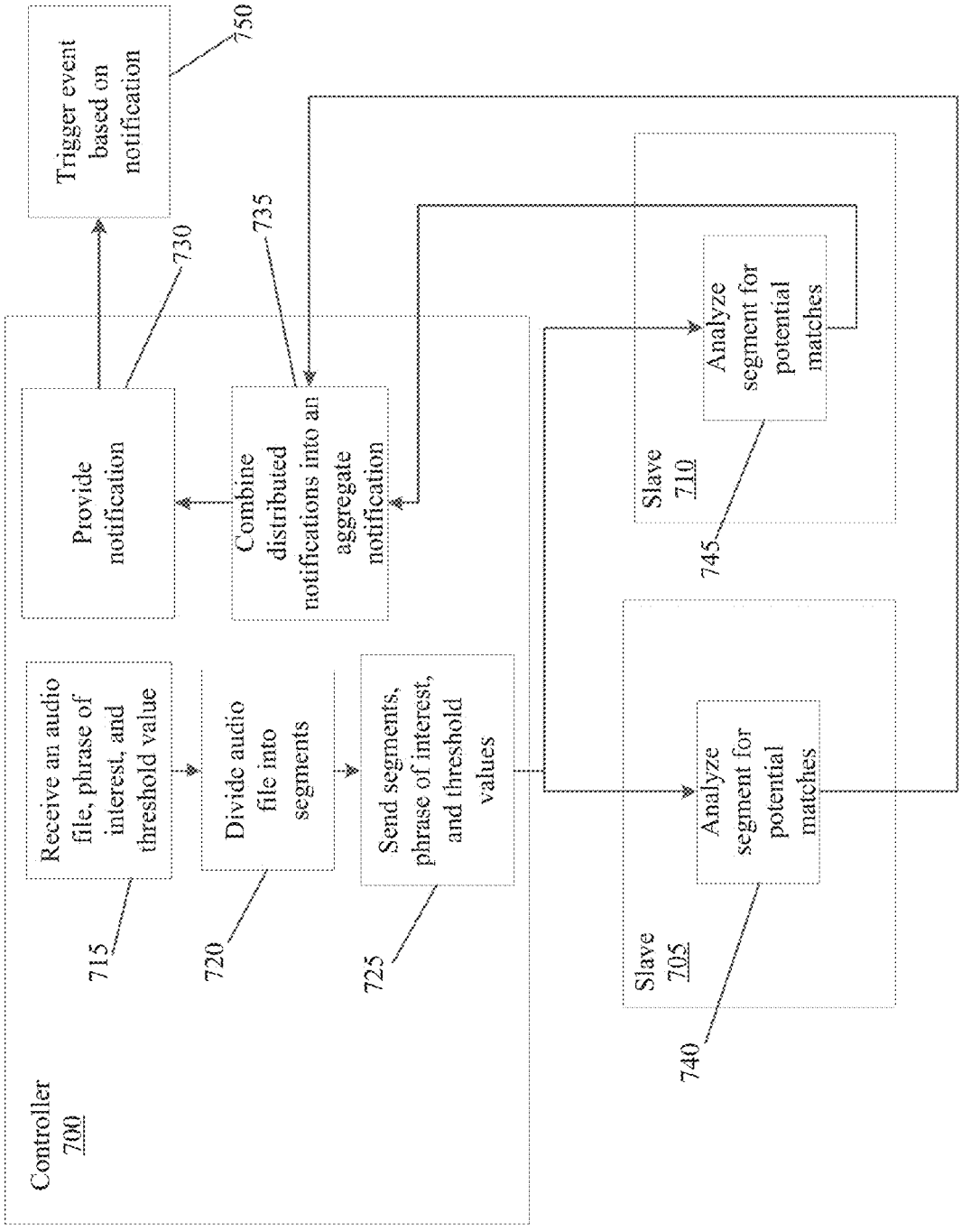
Controller
700
Receive an audio file, phrase of interest, and threshold value
715
Divide audio file into segments
720
Send segments, phrase of interest, and threshold values
725
Provide notification
730
Combine distributed notifications into an aggregate notification
735
Trigger event based on notification
750
Slave
705
Analyze segment for potential matches
740
Slave
710
Analyze segment for potential matches
745

FIG. 7

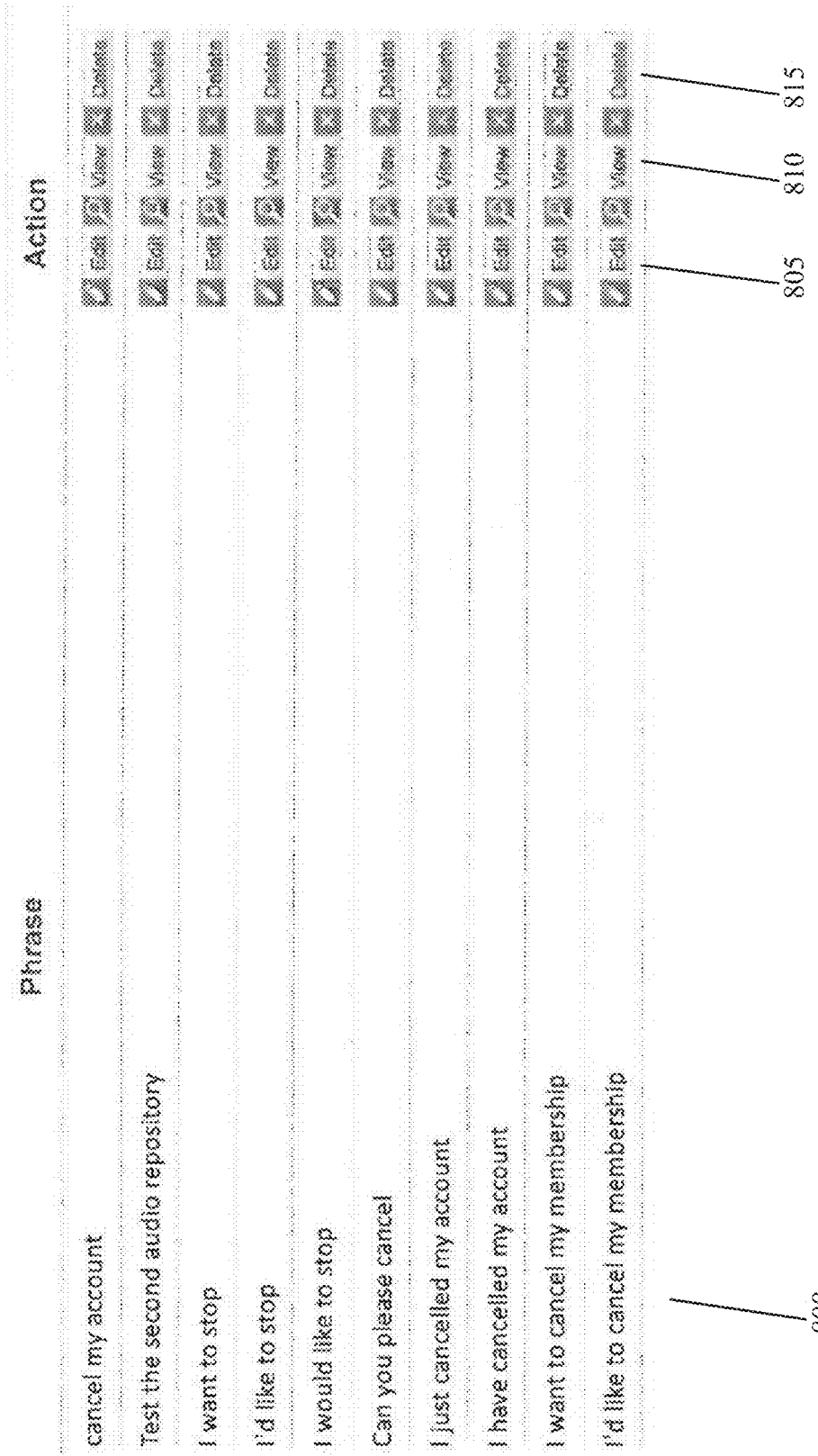
Phrase
Action
cancel my account
Edit View Delete
Test the second audio repository
Edit View Delete
I want to stop
Edit View Delete
I'd like to stop
Edit View Delete
I would like to stop
Edit View Delete
Can you please cancel
Edit View Delete
I just cancelled my account
Edit View Delete
I have cancelled my account
Edit View Delete
I want to cancel my membership
Edit View Delete
I'd like to cancel my membership
Edit View Delete
800
805
810
815

FIG. 8

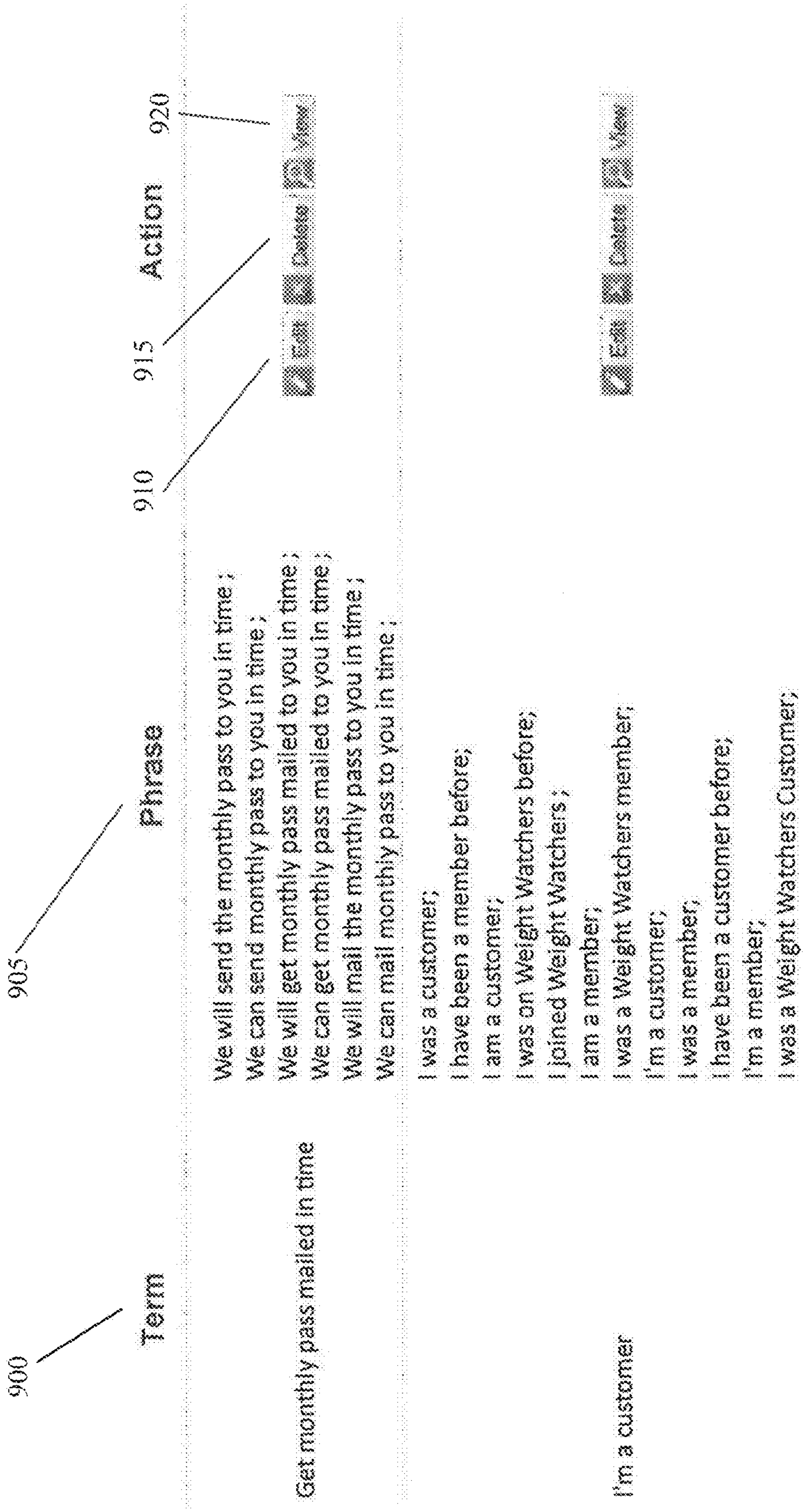
900
905
910
915
920
Term
Phrase
Action
Get monthly pass mailed in time
We will send the monthly pass to you in time ;
We can send monthly pass to you in time ;
We will get monthly pass mailed to you in time ;
We can get monthly pass mailed to you in time ;
We will mail the monthly pass to you in time ;
We can mail monthy pass to you in time ;
Edit
Delete
View
I'm a customer
I was a customer;
I have been a member before;
I am a customer;
I was on Weight Watchers before;
I joined Weight Watchers ;
I am a member;
I was a Weight Watchers member;
I'm a customer;
I was a member;
I have been a customer before;
I'm a member;
I was a Weight Watchers Customer;
Edit
Delete
View

FIG. 9

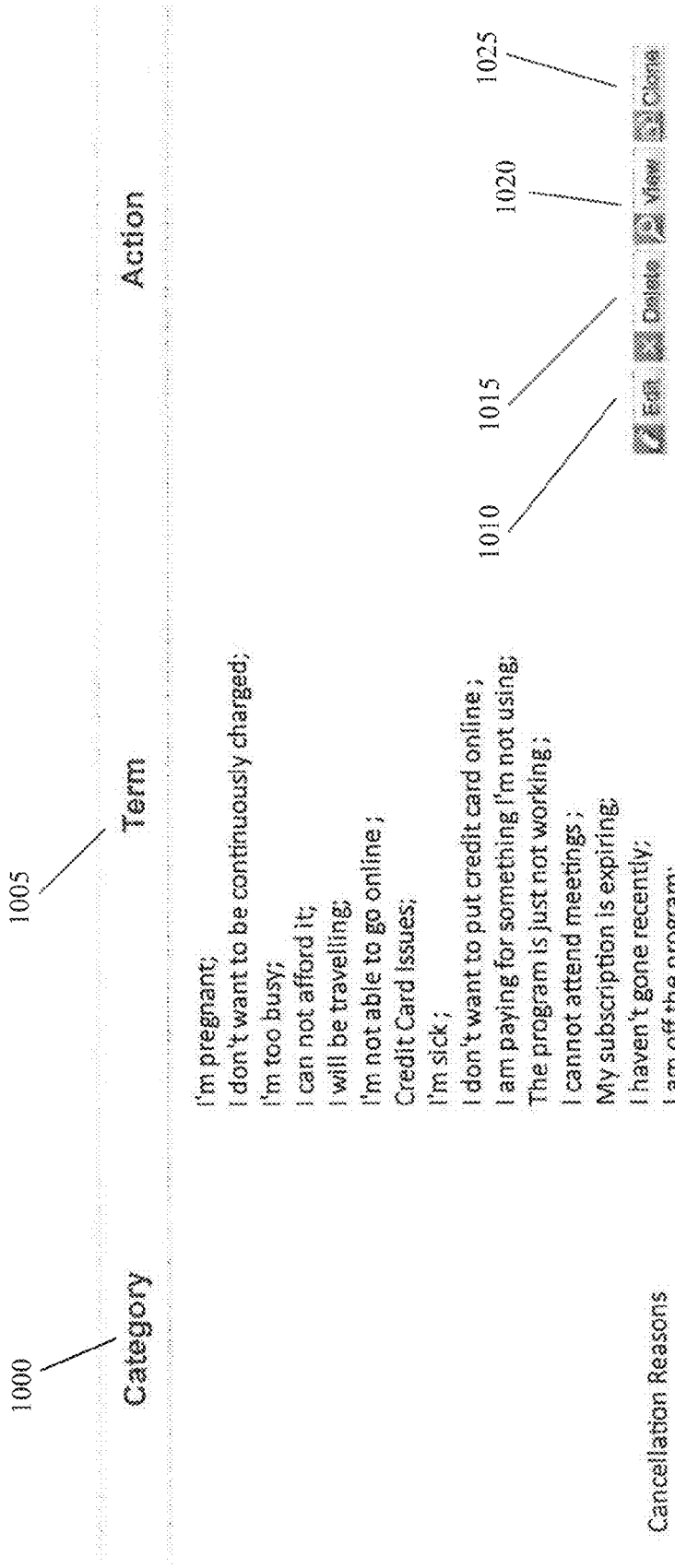
1000
1005
Category
Term
Action
Cancellation Reasons
I'm pregnant;
I don't want to be continuously charged;
I'm too busy;
I can not afford it;
I will be travelling;
I'm not able to go online ;
Credit Card issues;
I'm sick ;
I don't want to put credit card online ;
I am paying for something I'm not using;
The program is just not working ;
I cannot attend meetings ;
My subscription is expiring;
I haven't gone recently;
I am off the program;
I lost my job;
The program is very difficult;
I don't like recurring billing;
The billing process wasn't explained to me;
1010
1015
1020
1025
Edit
Delete
View
Clone

FIG. 10

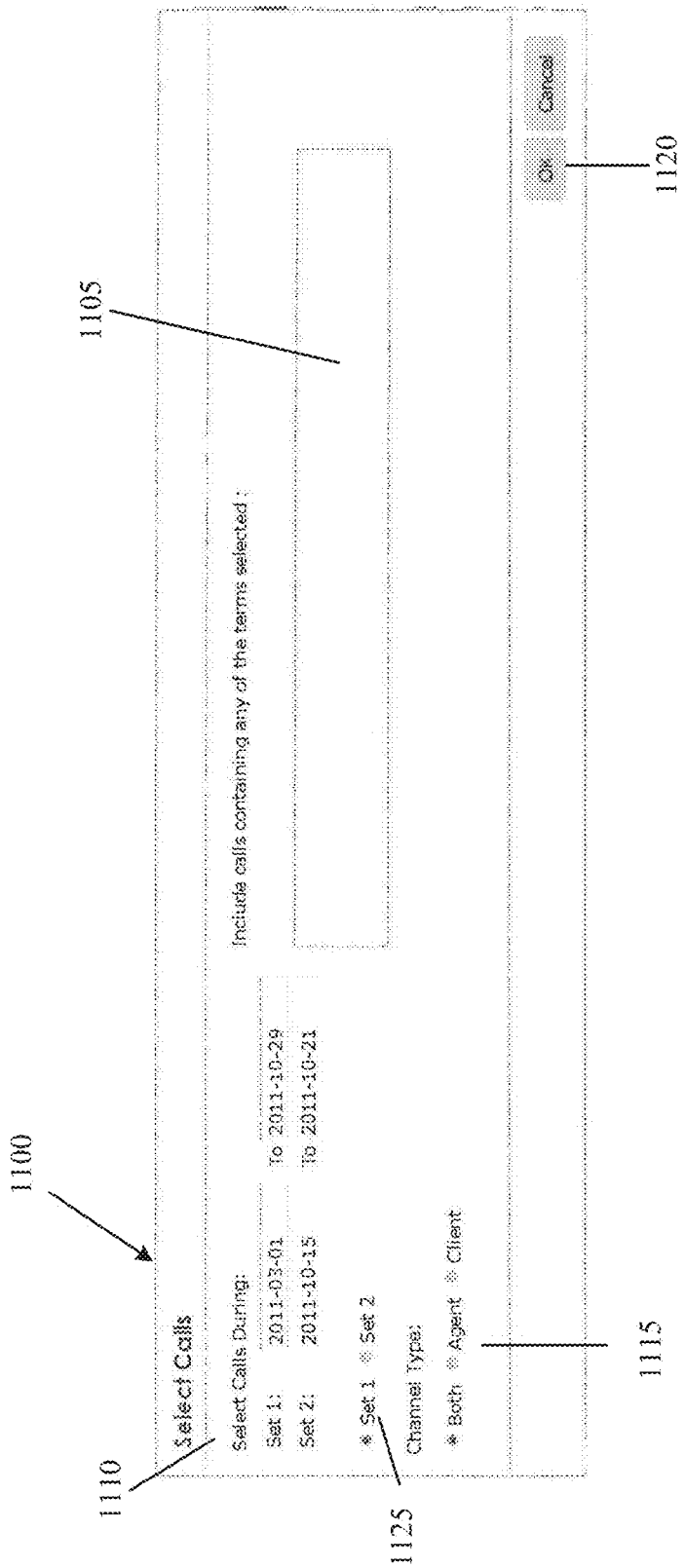
1100
1105
1110
1115
1120
1125
Select Calls
Select Calls During:
Set 1: 2011-03-01 To 2011-10-29
Set 2: 2011-10-15 To 2011-10-21
* Set 1 Set 2
Channel Type:
* Both Agent Client
Include calls containing any of the terms selected :
OK
Cancel

FIG. 11

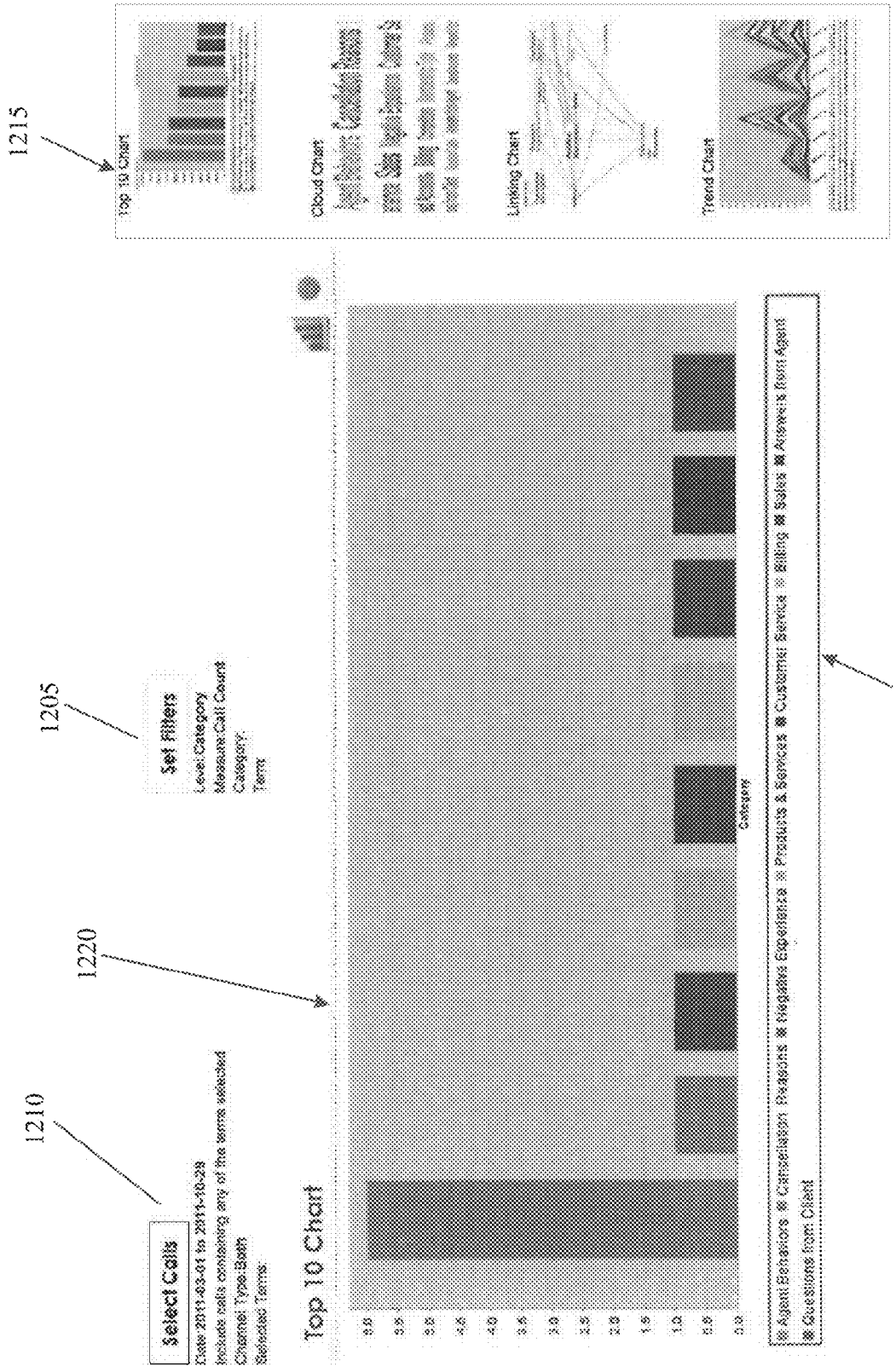
1215
Top 10 Chart
Cloud Chart
Linking Chart
Trend Chart
1205
Set Filters
Level: Category
Measure: Call Count
Category:
Term:
1220
1210
Select Calls
Include calls containing any of the terms selected
Channel Type: Both
Selected Terms:
Top 10 Chart
Category
Agent Behaviors
Campaign Reasons
Negative Experience
Products & Services
Customer Service
Billing
Sales
Answers from Agent
Questions from Client
1225

FIG. 12

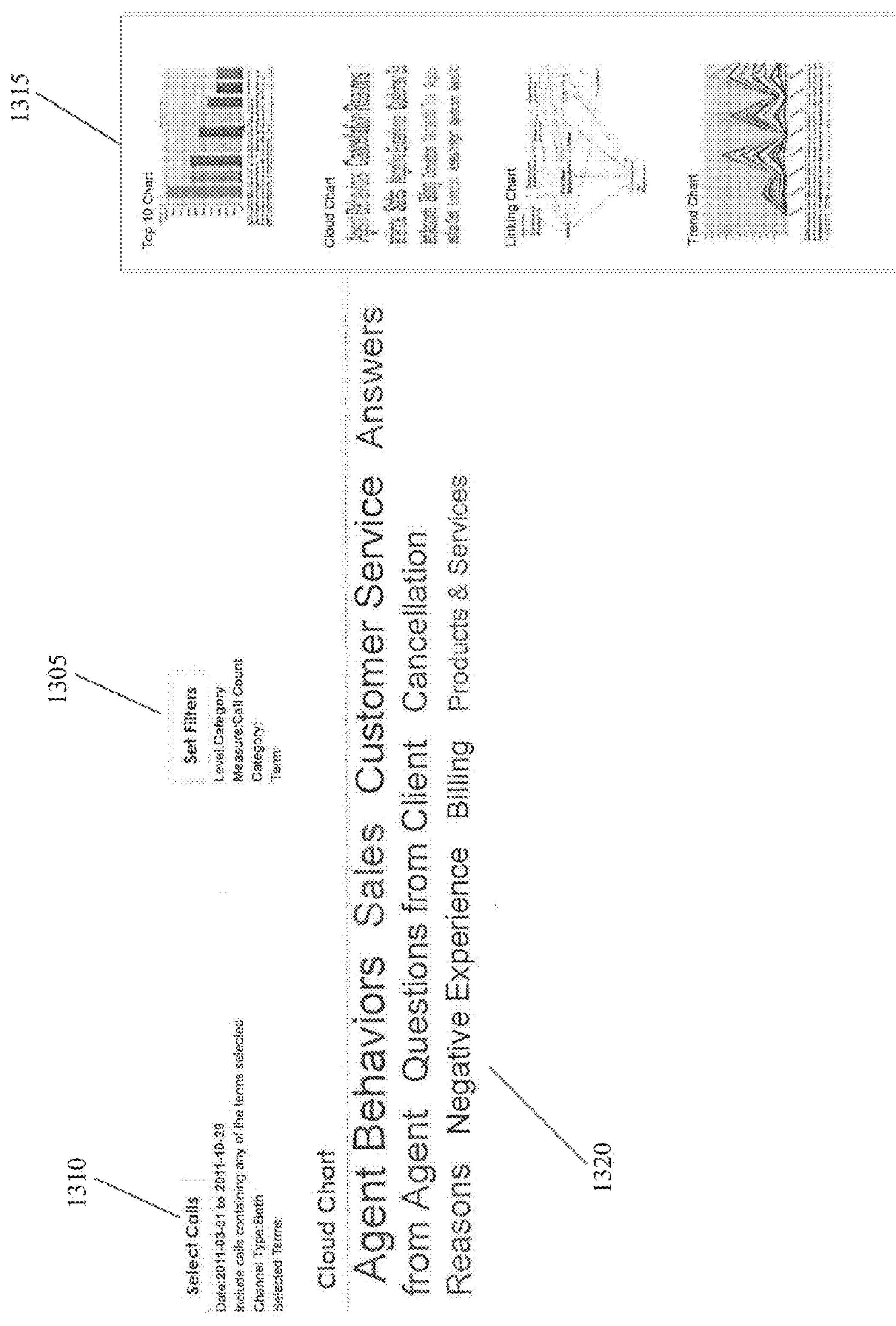
1310
Select Calls
Date:2011-03-01 to 2011-10-28
Include calls containing any of the terms selected
Channel Type:Both
Selected Terms:
1305
Set Filters
Level:Category
Measure:Call Count
Category:
Term:
1315
Top 10 Chart
Cloud Chart
Linking Chart
Trend Chart
Cloud Chart
Agent Behaviors Sales Customer Service Answers
from Agent Questions from Client Cancellation
Reasons Negative Experience Billing Products & Services
1320

FIG. 13

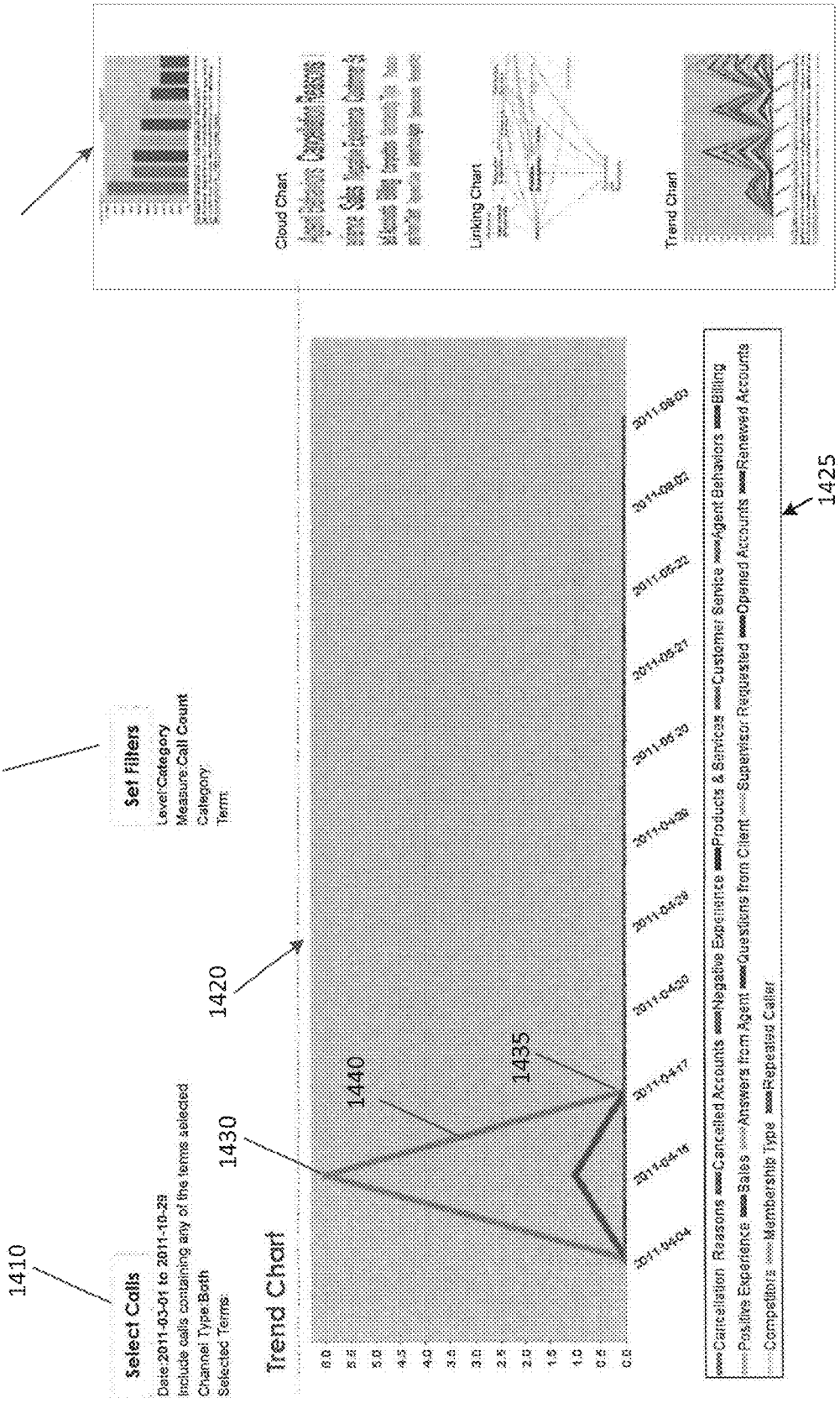
1415
Cloud Chart
Linking Chart
Trend Chart
1405
Set Filters
Level:Category
Measure:Call Count
Category:
Term:
1410
Select Calls
Date:2011-03-01 to 2011-10-28
Include calls containing any of the terms selected
Channel Type:Both
Selected Terms:
1430
Trend Chart
1420
1440
1435
1425
Cancellation Reasons
Cancelled Accounts
Negative Experience
Products & Services
Customer Service
Agent Behaviors
Billing
Positive Experience
Sales
Answers from Agent
Questions from Client
Supervisor Requested
Opened Accounts
Renewed Accounts
Competitors
Membership Type
Repeated Caller

FIG. 14

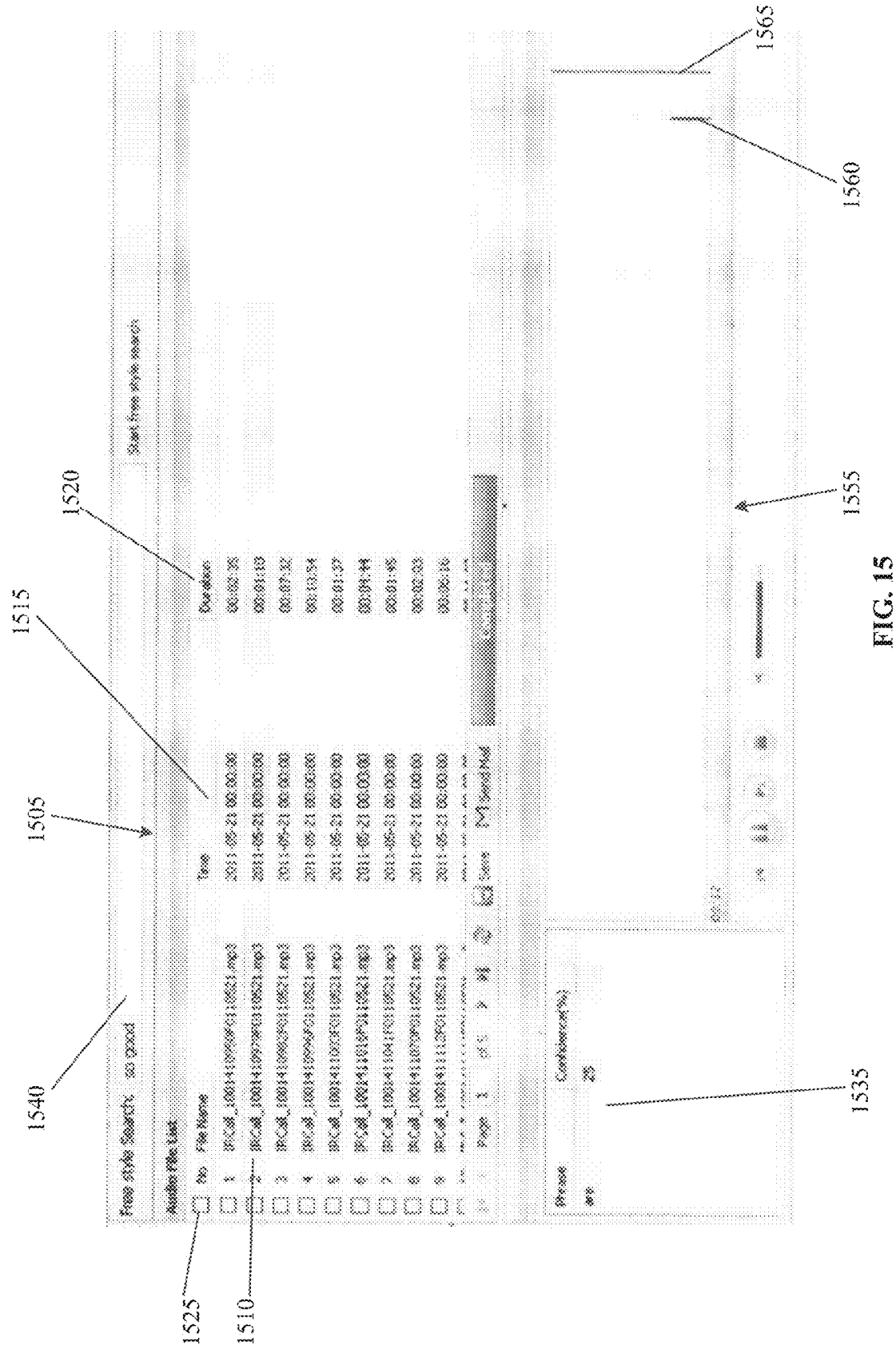

FIG. 15

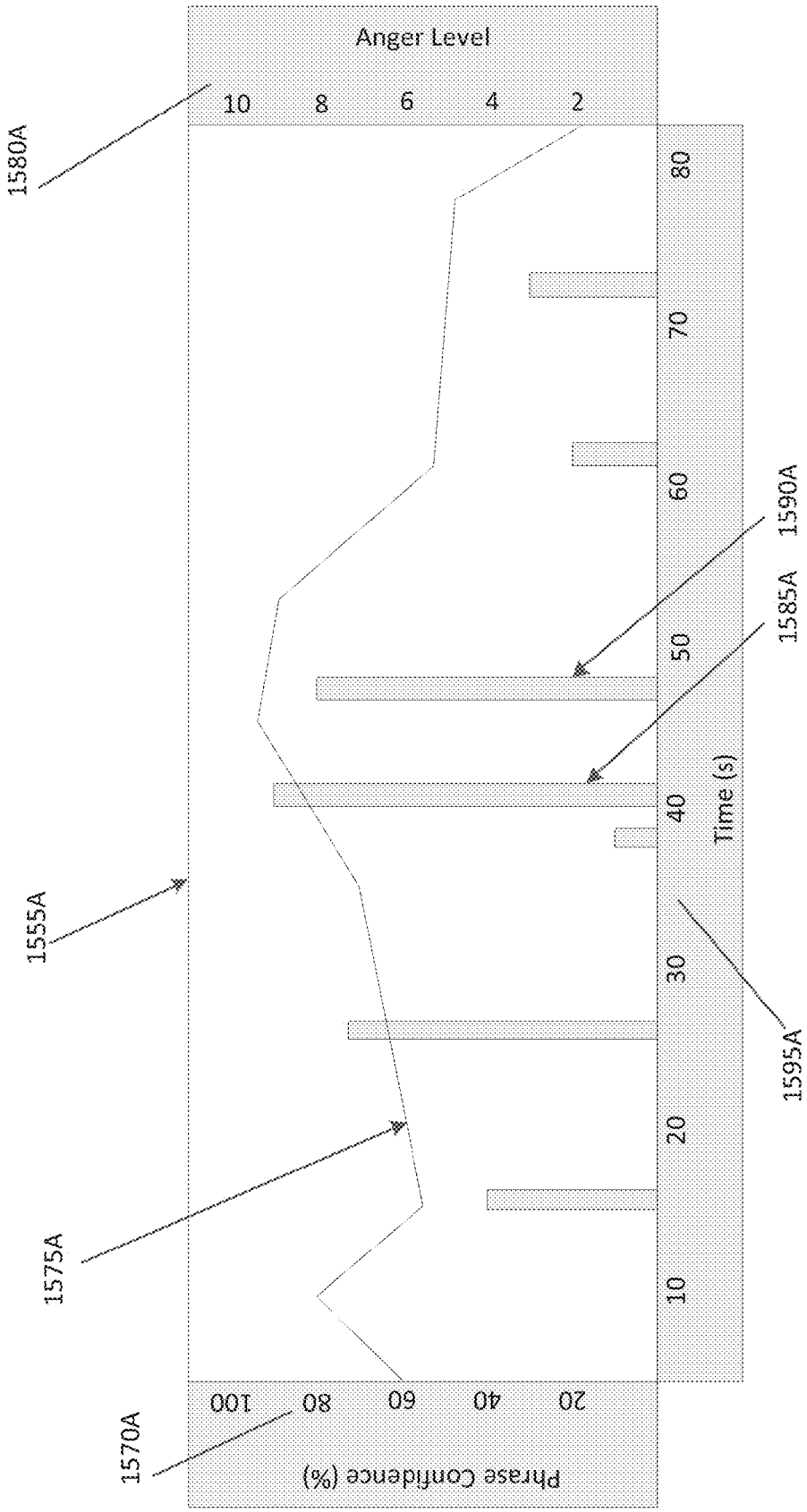
Anger Level
10
8
6
4
2
1580A
80
70
60
50
40
30
20
10
Time (s)
1590A
1585A
1595A
1555A
1575A
1570A
100
80
60
40
20
Phrase Confidence (%)

FIG. 15A

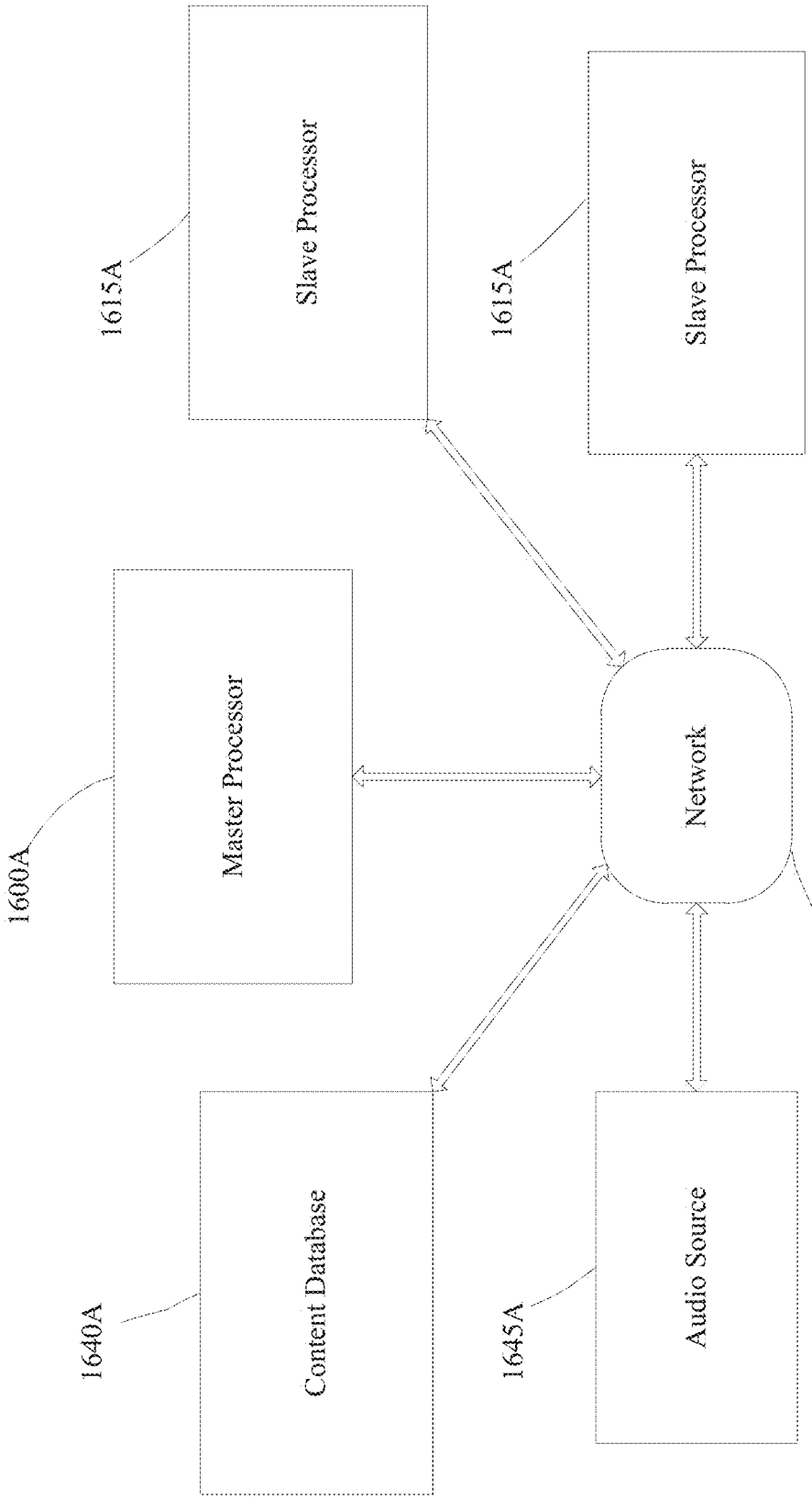
Slave Processor
1615A
Slave Processor
1615A
Master Processor
1600A
Network
1601A
Content Database
1640A
Audio Source
1645A

FIG. 16A

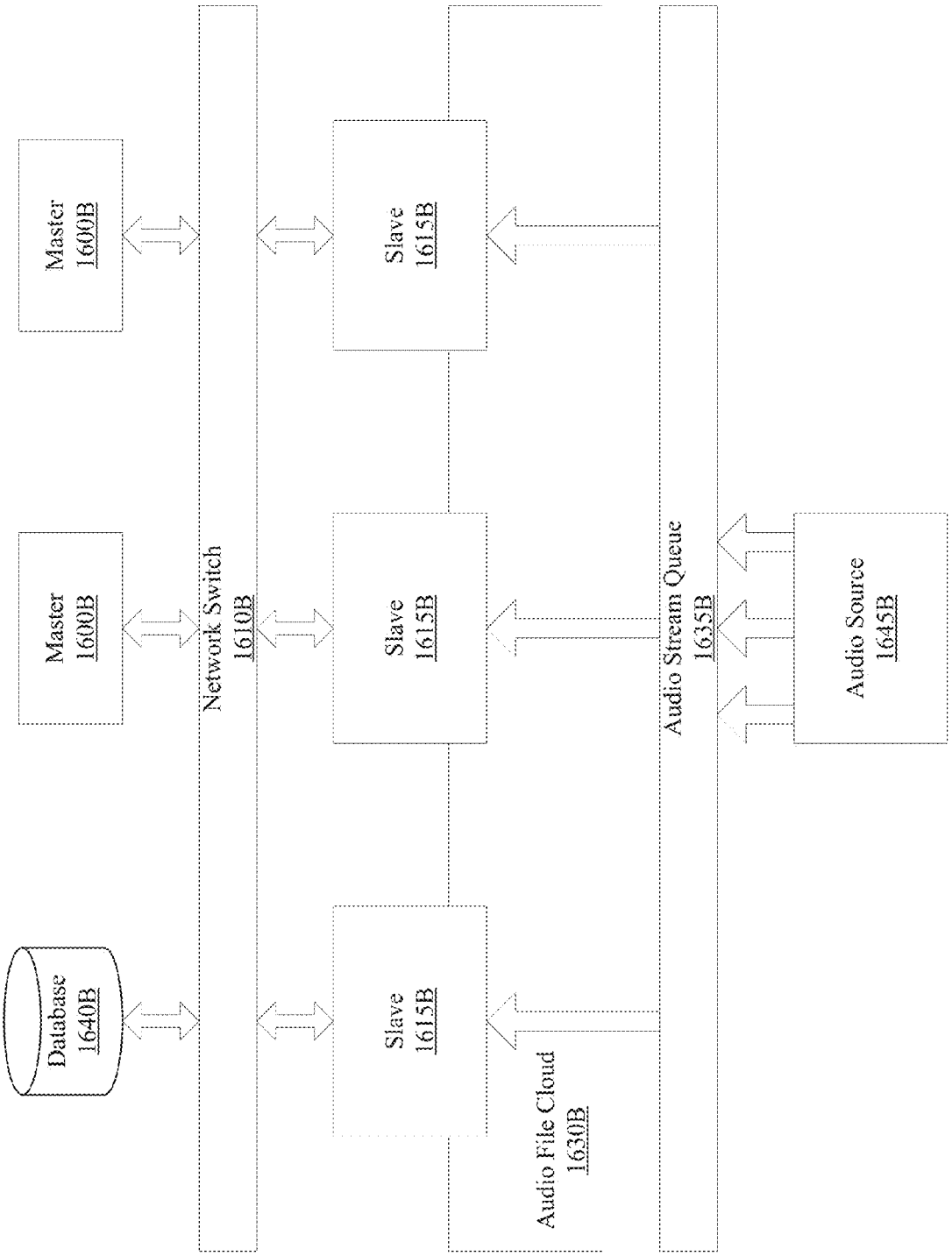
Master
1600B
Master
1600B
Database
1640B
Network Switch
1610B
Slave
1615B
Slave
1615B
Slave
1615B
Audio File Cloud
1630B
Audio Stream Queue
1635B
Audio Source
1645B

FIG. 16B

METHODS AND SYSTEMS RELATED TO AUDIO DATA PROCESSING TO PROVIDE KEY PHRASE NOTIFICATION AND POTENTIAL COST ASSOCIATED WITH THE KEY PHRASE

CROSS-REFERENCE TO RELATED DOCUMENTS

This application claims the benefit under 35 U.S.C. §119 (e) of U.S. Provisional Application Ser. No. 61/593,574 filed Feb. 1, 2012 and entitled "A mechanism and a process to capture and merge structured and unstructured business data from speech and other data sources to generate quantitative analysis and reports," which is hereby incorporated by reference.

TECHNICAL FIELD

The present disclosure is directed generally to methods and systems related to audio data processing. More particularly, various inventive methods and systems disclosed herein relate to methods and apparatus for analyzing audio data and/or performing quantitative analysis and reporting related to audio data.

BACKGROUND

Many businesses utilize one or more strategies to improve customer satisfaction based on investigating customer feedback and determining the purpose and/or outcome of interactions between customers and the business. For example, a business may have a customer service telephone system in place where conversations between customers and customer service representatives are monitored and issues are identified. Such audio data may assist a business in improving a service and/or product based on feedback from customers.

SUMMARY

The present disclosure is directed generally to methods and systems related to audio data processing. More particularly, various inventive methods and systems disclosed herein relate to analyzing audio data and performing quantitative analysis and reporting related to the data.

Generally, in one aspect, a computer implemented method of analyzing content originating from an audio source is provided and includes the steps of: identifying an audio file, where the audio file is representative of spoken content of at least one speaker; identifying a key phrase, where the key phrase includes one or more words of interest; identifying a cost, where the cost is based on a value of at least one of the presence of and the absence of the key phrase in the audio file; identifying a candidate phrase in the audio file, where the candidate phrase is representative of one or more words spoken by the at least one speaker and present in the audio file; associating a confidence level with the candidate phrase, where the confidence level is based on a probability that the candidate phrase matches the key phrase; identifying a threshold confidence level; determining whether the confidence level satisfies the threshold confidence level; and providing a notification when the confidence level satisfies the threshold confidence level, the notification providing an indication of the presence of the key phrase in the audio file; where the providing of the notification is at least partially based on the cost.

Generally, in another aspect, a computer implemented method of analyzing content originating from an audio source is included and includes the step of: receiving an audio file, where the audio file is representative of spoken content of at least one speaker; identifying a key phrase, where the key phrase includes one or more words which a user has interest in identifying in the audio file; receiving a cost, where the cost is indicative of a value of at least one of the presence of and the absence of the key phrase in the audio file; identifying a candidate phrase in the audio file, where the candidate phrase is representative of one or more words spoken by the at least one speaker in the audio file and is a likely match for the key phrase; identifying a threshold cost value; determining whether the cost satisfies the threshold cost value; and providing a notification when the cost satisfies the threshold cost value, the notification providing an indication of the presence of the key phrase in the audio file.

Generally, in another aspect, a system is provided and includes: a first analysis processor, the first analysis processor operable to execute instructions stored in memory, including instructions to: receive a first audio file segment, where the first audio file segment is representative of spoken content of at least one speaker; receive a key phrase, where the key phrase includes one or more words of interest; identify a cost, where the cost is based on a value of at least one of the presence of and the absence of the key phrase in an audio source; identify a first candidate phrase in the audio file segment, where the first candidate phrase is representative of one or more words spoken by the at least one speaker and present in the audio file segment; associate a first confidence level with the first candidate phrase, where the first confidence level is based on a probability that the first candidate phrase matches the key phrase; identifying a first threshold confidence level; determine whether the first confidence level satisfies the threshold confidence level; and provide a first notification when the first confidence level satisfies the first threshold confidence level, the first notification providing an indication of the presence of the key phrase in the audio file; where the providing of the first notification is at least partially based on the cost.

In various implementations, a processor or controller may be associated with one or more storage media (generically referred to herein as "memory," e.g., volatile and non-volatile computer memory such as RAM, PROM, EPROM, and EEPROM, floppy disks, compact disks, optical disks, magnetic tape, etc.). In some implementations, the storage media may be encoded with one or more programs that, when executed on one or more processors and/or controllers, perform at least some of the functions discussed herein. Various storage media may be fixed within a processor or controller or may be transportable, such that the one or more programs stored thereon can be loaded into a processor or controller so as to implement various aspects of the present invention discussed herein. The terms "program" or "computer program" are used herein in a generic sense to refer to any type of computer code (e.g., software or microcode) that can be employed to program one or more processors or controllers.

Other implementations may include a non-transitory computer readable storage medium storing instructions executable by a processor to perform a method such as one or more of the methods described herein. Yet another implementation may include a system including memory and one or more processors operable to execute instructions, stored in the memory, to perform a method such as one or more of the methods described herein.

It should be appreciated that all combinations of the foregoing concepts and additional concepts discussed in greater

detail herein are contemplated as being part of the inventive subject matter disclosed herein. For example, all combinations of claimed subject matter appearing at the end of this disclosure are contemplated as being part of the inventive subject matter disclosed herein.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a block diagram of an example computer system.

FIG. **2** is a block diagram illustrating an example environment of a system for analyzing data from speech and other sources to generate quantitative analysis and reports.

FIG. **3** is a flow chart illustrating an embodiment of a method for analyzing audio and text files to refine search terms.

FIG. **4** is a flow chart illustrating an embodiment of a method for searching an audio file for one or more key phrases of interest.

FIG. **5** is a flowchart illustrating an embodiment of a method for searching an audio file for one or more key phrases of interest and triggering a subsequent event.

FIG. **6** is a flow chart illustrating an embodiment of a method to search an audio file for the co-occurrence of two phrases.

FIG. **7** is a flow chart illustrating an embodiment of a method for using distributed computing processors to locate one or more key phrases in an audio file.

FIG. **8** illustrates an example graphical user interface for selecting search terms that may be implemented in an embodiment of an audio file search engine.

FIG. **9** illustrates an example graphical user interface for displaying a search phrase hierarchy that may be implemented in an embodiment of an audio file search engine.

FIG. **10** illustrates an example graphical user interface for displaying a search term hierarchy that may be implemented in an embodiment of an audio file search engine.

FIG. **11** illustrates an example graphical user interface for inputting search terms that may be implemented in an embodiment of an audio file search engine.

FIG. **12** illustrates an example graphical user interface for a bar graph to display information regarding the presence of phrases in audio files which may be implemented in an embodiment of an audio file search engine.

FIG. **13** illustrates an example graphical user interface for a word cloud to display information regarding the presence of phrases in audio files which may be implemented in an embodiment of an audio file search engine.

FIG. **14** illustrates an example graphical user interface for a trend graph to display information regarding the presence of phrases in audio files which may be implemented in an embodiment of an audio file search engine.

FIG. **15** illustrates aspects of an example graphical user interface for displaying audio file results information regarding audio files that contain one or more phrases which may be implemented in an embodiment of an audio file search engine.

FIG. **15**A is an example of an audio visualization box from an example graphical user interface for displaying audio search results.

FIG. **16**A is a block diagram illustrating an example of a scalable distributed computing environment for processing audio data.

FIG. **16**B is a block diagram illustrating an example environment of a system for analyzing audio data utilizing cloud computing.

DETAILED DESCRIPTION

Referring to FIG. **1**, a block diagram of an example computer system **110** is provided. Computer system **110** typically includes at least one processor **114** which communicates with a number of peripheral devices via bus subsystem **112**. These peripheral devices may include a storage subsystem **124**, including, for example, a memory subsystem **126** and a file storage subsystem **128**, user interface input devices **122**, user interface output devices **120**, and a network interface subsystem **116**. The input and output devices allow user interaction with computer system **110**. Network interface subsystem **116** provides an interface to outside networks and is coupled to corresponding interface devices in other computer systems.

User interface input devices **122** may include a keyboard, pointing devices such as a mouse, trackball, touchpad, or graphics tablet, a scanner, a touchscreen incorporated into the display, audio input devices such as voice recognition systems, microphones, and/or other types of input devices. In general, use of the term "input device" is intended to include all possible types of devices and ways to input information into computer system **110** or onto a communication network.

User interface output devices **120** may include a display subsystem, a printer, a fax machine, or non-visual displays such as audio output devices. The display subsystem may include a cathode ray tube (CRT), a flat-panel device such as a liquid crystal display (LCD), a projection device, or some other mechanism for creating a visible image. The display subsystem may also provide non-visual display such as via audio output devices. In general, use of the term "output device" is intended to include all possible types of devices and ways to output information from computer system **110** to the user or to another machine or computer system.

Storage subsystem **124** stores programming and data constructs that provide the functionality of some or all of the modules described herein. For example, the storage subsystem **124** may include the logic to process an audio file, search an audio for the presence of one or more terms, analyze audio file search result, and/or display audio file search results according to one or more processes described herein.

These software modules are generally executed by processor **114** alone or in combination with other processors. Memory **126** used in the storage subsystem can include a number of memories including a main random access memory (RAM) **130** for storage of instructions and data during program execution and a read only memory (ROM) **132** in which fixed instructions are stored. A file storage subsystem **128** can provide persistent storage for program and data files, and may include a hard disk drive, a floppy disk drive along with associated removable media, a CD-ROM drive, an optical drive, or removable media cartridges. The modules implementing the functionality of certain implementations may be stored by file storage subsystem **128** in the storage subsystem **124**, or in other machines accessible by the processor(s) **114**.

Bus subsystem **112** provides a mechanism for letting the various components and subsystems of computer system **110** communicate with each other as intended. Although bus subsystem **112** is shown schematically as a single bus, alternative implementations of the bus subsystem may use multiple busses.

Computer system **110** can be of varying types including a workstation, server, computing cluster, blade server, server farm, or any other data processing system or computing device. Due to the ever-changing nature of computers and networks, the description of computer system **110** depicted in FIG. **1** is intended only as a specific example for purposes of illustrating some implementations. Many other configura-

tions of computer system **110** are possible having more or fewer components than the computer system depicted in FIG. **1**.

Referring to FIG. **2**, a block diagram illustrating an example environment of a system for analyzing data from speech and other sources to generate quantitative analysis and reports is provided. Audio search module **200** may share one or more aspects with one or components of the computer architecture as illustrated in FIG. **1**. Audio search module **200** may perform one or more steps in the flowcharts illustrated in FIGS. **3** through **7** and described herein. In the illustrated environment, initial data to populate the system is received from one or more sources. In some implementations, initial company data may originate from one or more external text sources **255** which may include customer relationship data **210**, internal company documents **205**, and/or user generated content **215**. In some implementations, additional and/or alternate text sources may be utilized by the system. Internal company documents **205** may be comprised of, for example, company text documents, company websites, and/or one or more resources from within a company. User generated content **215** may be comprised of one or more dynamic sources, such as TWITTER, FACEBOOK, text messages, data received via BLUETOOTH, and/or input via the Internet, such as from a text form on a website and/or user comments on a blog and/or an online forum. For example, a company may have a website with a user comments page, which a user may utilize to submit feedback and/or a company may have a user forum to allow users to post comments and/or complaints about the company. Text mining engine **245** may use one or more external text sources **255** to generate potential key phrases for later analysis.

Audio source **220** may include data which is received via an audio network, such as a telephone network. Audio files from audio source **220** may be stored directly in audio database **225** and/or audio files may be received directly by audio search module **200** for analysis in real time. Audio search module **200** may additionally and/or alternatively retrieve audio files from audio database **225** for analysis. Audio files received directly from audio source **220** and/or audio files retrieved from audio database **225** may be analyzed by one or more components and/or modules of audio search module **200**, such as phonetic search engine **230** and/or emotional recognition engine **235**. Audio files and/or data files derived from one or more audio files stored in audio database **225** and/or audio files and/or data derived from one or more audio files received directly by audio search module **200** may be utilized in future searches to locate potential key phrases in the audio files. In some implementations, database **225** may store metadata associated with an audio file and/or an audio file segment. In some implementations, the metadata may include one or more determined characteristics of the audio file such as, for example, date when the audio file was recorded, telephone number and/or account number of a customer in a recording, and/or length of an audio file. In some implementations, audio database **225** may be a remote database and/or may utilize cloud computing to store and/or retrieve audio files. In some implementations, multiple audio databases may work in conjunction to store one or more aspects of audio files. For example, one or more databases may be utilized to store metadata associated with audio files, such as timestamps, speaker identification information, and/or analysis results provided by phonetic search engine **230**, emotion recognition engine **235**, and/or phrase search results from previous searches. One or more separate databases may store the audio files received by audio sources **220** and/or a compressed or manipulated version of an audio stream received by audio sources **220**. For example, a phone conversation may be recorded as an MP3 file, stored in audio database **225**, and later accessed by audio search module **200**, phonetic search engine **230**, and/or emotional recognition engine **235** for further analysis. In some implementations, audio files may be initially processed and/or analyzed for search terms utilizing an environment which shares one or more characteristics the environment illustrated in FIG. **16**.

One or more phrases from one or more external text sources **255** may be directed to text mining engine **245** for further analysis. Text mining engine **245** may analyze the content of text sources, the purpose for creating of one or more text sources, and/or the result of interactions with customers recorded in text sources. Text mining engine **245** may further associate a cost with one or more phrases identified in external text sources **255**. A cost may be associated with a phrase to reflect the importance of an instance where that phrase is mentioned. In some implementations, the cost associated with a phrase may be related to a monetary cost which may be incurred and/or gained when the associated phrase is mentioned in an audio file. For example, user generated content **215** may contain a posting by a customer on a company's FACEBOOK page. Multiple customers may use the phrase "I'm not satisfied" in a posting, and text mining engine **245** may determine that the phrase "I'm not satisfied" is important and should be flagged as a phrase that should be used as a search term in audio files containing conversations between company representative and customers. In some implementations, text mining engine **245** may further associate a cost with the phrase based on additional information from one or more sources. As another example, an internal document **205** may be generated by a customer service representative based on a customer canceling a subscription to services. Text mining engine **245** may discover the proximity of the words "cancel" and "subscription" in the internal document **205** and use those two words as key phrases in future searches of audio files.

Text mining engine **245** may further additionally and/or alternatively associate a cost with a key phrase based on metadata associated with a particular text document. For example, a company budget may be received by text mining engine **245** to search for possible key phrases. Text mining engine **245** may associate the phrase "canceled subscriptions" with a corresponding cost (e.g., a monthly cost, an annual cost, the cost associated with the remainder of the term of the cancelled subscription). Searches of audio files may allow a company to assess budgetary needs based on real monetary values associated with key phrases. Identified phrases from external text sources **255** may be transmitted from text mining engine **210** to audio search module **200** in the form of a search tree and/or other pertinent form which may be utilized by audio search module **202** to associate the relevancy of one or more identified phrases based on the occurrence of individual phrases, the co-occurrence of two or more phrases in proximity, and/or the non-occurrence of one or more phrases. In some implementations, a cost may be associated with the occurrence and/or non-occurrence of one or more phrases. In some implementations a cost may be associated with the occurrence and/or non-occurrence of one or more phrases in a group of two or more phrases. Associations between one or more potential search phrases may further assist a user and/or audio search module **200** in future searches of audio files.

Database **250** may store analysis results from text mining engine **245**, phonetic search engine **230**, emotion recognition engine **235**, data mining engine **240**, audio search module **200**, and/or raw data received from external text sources **255**

and/or audio sources **220**. In some implementations, audio search module **200** may access data stored in database **250** for further analysis and/or to perform searches on audio files using identified phrases. In some implementations, audio search module **200** may transmit audio search results to database **250** for later display and/or further analysis. Database **250** may be comprised of multiple databases, may be located locally, and/or may be accessible remotely via network communication and/or cloud computing.

In some implementations, text files from customer relationship management data **210**, internal company documents **205**, and/or user generated content **215** may be processed by one or more additional tools before data is sent to audio search module **200** and/or text mining engine **245**. For example, user generated content **220** may be transmitted to a system management agent (SMA) tool to transform content from various sources into a uniform format for analysis by audio search module **200** and/or text mining engine **210**. SMA tool **215** may mine data from sources utilizing one or more user generated protocols for potential search terms present in those sources. Customer relationship data **210** may be organized by a customer relationship management application to mine files for potential search phrases and manage documents related to a company's interactions with past, current and future customers. A customer relationship management application may organize, automate, and/or synchronize information from one or more sources, such as written complaints from customers, notes generated by a customer service representative while speaking with a customer, and/or emails sent by customers to the company. Text mining engine **245** may further analyze data generated by an SMA tool and/or customer relationship management application in order to generate descriptive and/or predictive data mining models.

Data mining engine **240** may be utilized to further analyze data generated by text mining engine **245**, data stored in database **250**, search results received from audio search module **200**, and/or text from external text sources **255**. Data mining engine **240** may receive "hard" data from the sources and generate descriptive and/or predictive data models based on the frequency of phrases in documents, the purpose of one or more documents, and/or customer service representative notations in one or more documents.

Phonetic search engine **230** may be utilized by audio search module **200** to analyze audio sources **220** and/or audio database **225**. In some implementations phonetic search engine **230** may process an audio file into a format which, in some implementations, is more easily searched for key terms and phrases. For example, phonetic search engine **230** may transcribe the contents of an audio file into a text file so that individual terms may be extracted. In some implementations, phonetic search engine **230** may perform further analysis on audio files to extract potential key phrases to be used in later analysis of additional audio files. For example, phonetic search engine **230** may encounter the phrase "I'd like to cancel my account" multiple times in one or more audio files. Phonetic search engine **230** may determine that the phrase "I'd like to cancel my account" is important and suggest to audio search module **200** to use that phrase as a search term in future searches of audio files from audio sources **220** and/or audio database **225**. Results of analysis by phonetic search engine **230** may be transmitted to audio database **225** and/or database **250** for storage. In some implementations, metadata generated by phonetic search engine **230** may be transmitted to a separate database for storage.

Emotion recognition engine **235** may be utilized to analyze one or more audio files generated by audio sources **220** and/or one or more audio files stored in audio database **225**. Emotion recognition engine **235** may analyze the voice of a speaker on an audio file and identify potential emotions of the speaker based on one or more characteristics of the voice such as, for example: language used, volume of the speaker's voice, speed of the speaker's speech patterns, and/or inflection in the speaker's voice. In some implementations, emotion recognition engine **235** may identify the emotion of a speaker and an associated confidence level that the speaker is experiencing the suggested emotion. In some implementations, emotion recognition engine **235** may suggest multiple potential emotions with corresponding confidence levels. Results of analysis by emotion recognition engine **235** may be transmitted to audio database **225** and/or database **250** for storage. In some implementations, metadata generated by emotion recognition engine **235** may be transmitted to a separate database for storage.

A user may interact with audio search module **200** via workstation **270**. In some implementations, workstation **270** may display one or more of the graphical user interfaces (GUIs) illustrated in FIGS. **9** through **15** and described herein. In some implementations a user may interact with audio search module **200** using workstation **270** to, for example: input one or more key phrases of interest which the user would like to locate in an audio file; alter and/or delete key phrases of interest which the audio search module **200** has generated; view search results generated by audio search module **200** from searches executed on one or more audio files; and/or access one or more audio files for further analysis. In some implementations, one or more additional workstations **270** may be present and may accommodate multiple users of the audio search module **200**. In some implementations, the user of workstation **270** may be limited in accessible functionality based on a user's permissions. For example, a manager may have access to interfaces which allow a user to edit and/or delete potential search phrases. A customer service representative may have limited access to one or more interfaces displays to limit allowable alterations to audio search module **200**.

Audio search module **200** processes data received from external text sources **255**, audio sources **220**, workstation **270**, and/or one or more additional databases and determines one or more key phrases of interest to locate in audio files. In some implementations, audio search module **200** will analyze sources utilizing text mining engine **245**, data mining engine **240**, phonetic search engine **230**, and/or emotion recognition engine **235** to identify one or more key search terms or phrases for utilization in further analysis of audio files. For example, audio search module **200** may receive an indication from text mining engine **245** that the phrase "I'd like to cancel my subscription" appears regularly in one or more external documents. Audio search module **200** may flag the phrase "I'd like to cancel my subscription" as a potentially important phrase and subsequently search future audio files and/or previously recorded audio files stored in audio database **225** and/or database **250** for the phrase "I'd like to cancel my subscription" to locate other occurrences of the phrase in one or more audio files. Additionally or alternatively, audio search module **200** may utilize data from one or more additional components in order to make adjustments to one or more characteristics of a phrase to increase the effectiveness of future searches. For example, audio search module **200** may execute a search on an audio file, determine that the search identified the non-occurrence of a search phrase, and adjust the confidence level associated with the search phrase for use in future audio file searches. In some implementations, a user may access audio search module **200** via workstation **270** and manually edit one or more search phrases, input additional

search phrases, and/or delete potential key search phrases which have been erroneously identified by audio search module **200** as pertinent.

Audio search module **200** may categorize one or more key phrases into broader categories based on identifications made by text mining engine **245**, data mining engine **240**, emotion recognition engine **235**, and/or phonetic search engine **230**. A category may be associated with one or more terms which are broadly related to each other. For example, a category may be named "Cancellation Reasons" and that category may be associated with terms such as "I cannot afford it," "credit card issues," and/or "I lost my job." One or more phrases may optionally be categorized based on terms. For example, the phrases "We will send the monthly pass to you in time," "We can mail a monthly pass to you," and/or "We will get monthly pass mailed to you in time" may be associated with the term "Get monthly pass mailed in time" based on the presence and/or proximity of one or more words and/or phrases (e.g., "monthly," "pass," "time," "monthly pass"). Additionally, for example, "Get monthly pass mailed in time" may be associated with the broader category "Customer Service." One or more terms and/or categories may be utilized by audio search module **200** to search audio files for multiple phrases without the need to select phrases of interest individually. For example, the category "Cancellation Reasons" may be identified as a search input. Audio search module **200** may search one or more audio files based on phrases associated with terms associated with the category "Cancellation Reasons," ("Get monthly pass mailed in time," "We will send the monthly pass to you in time," "We can mail a monthly pass to you." In some implementations, audio search module **200** may recognize broader categories based on information determined by one or more analysis engines and may automatically associate a phrase with an existing category and/or term. In some implementations, audio search module **200** may create one or more new categories and/or terms based on suggestions from one or more engines. For example, data mining engine **240** may determine that text files which contain "cancel" and "subscription" were often generated in response to a customer requesting the cancellation of one or more services and the one or more text files containing those phrases also contained information regarding the reasons why a customer decided to cancel the services. In that case, audio search module **200** may associate the phrase "I'd like to cancel my subscription" with a category entitled "Cancellation Reasons." One or more additional phrases may subsequently be associated with the category "Cancellation Reasons" as suggested by an analysis engine. For example, "I would like to stop" may also be associated with the category "Cancellation Reasons." In some implementations, a user of workstation **270** may manually associate or disassociate one or more phrases with a category. In some implementations, a workstation **270** may utilize display interfaces which may share one or more characteristics with the graphical user interfaces illustrated in FIGS. **8** through **10** and described herein.

Audio search module **200** may utilize analysis from one or more analysis engines in order to assign a cost to a suggested key phrase. An associated cost may reflect a monetary cost which may be incurred when a given phrase is located or is absent from an audio file. In some implementations, associated cost may reflect the importance of an audio file where the associated key phrase is located. For example, a cost of $19.99 may be associated with a phrase categorized in the "Cancellation Reasons" category. The cost may be the monetary value of a customer's subscription to the company's services and, if an audio file contains a phrase in the category "Cancellation Reasons," an audio file reflecting a customer canceling services may be utilized to adjust a budget for the company. In some implementations, an associated cost may be determined based on a status and/or characteristic of a customer. For example, a cost may be based on the value of a customer's business to a company. A company may incur a significant loss if a valued customer cancels a service, so a larger cost may be associated with one or more phrases based on the status of the customer in an audio file. Also, for example, an associated cost for one phrase may vary based on the customer. A customer who has a higher monthly subscription cost may have a larger cost associated with a phrase than a customer with a lower monthly subscription cost. In some implementations, a cost may reflect the importance of flagging an audio file for further analysis when a particular phrase is present or not present in the audio file. For example, the phrase "I'm angry" may be very important to a company because a supervisor would be interested in listening to the reason or reasons why customer is angry. Audio search module **200** may assign the phrase "I'm angry" with a high cost value so that an audio file containing that phrase is more likely to trigger a subsequent modification to a supervisor. In some implementations, audio search module **200** may adjust a cost assigned to a phrase based on historic evidence of results of audio file searches. For example, data mining engine **240** may determine that cancellations occur in 50% of files which contain the phrase "I'd like to cancel." Initially, audio search module **200** may assign a cost of $19.99 to the phrase, but after analysis and results of one or more subsequent audio files, the cost may be adjusted to $9.99 to reflect the average cost when files contain the phrase "I'd like to cancel." In some implementations, the particular cost associated with a phrase may be based on attributes that are unique to the particular customer that spoke the phrase. For example, an associated cost may be based on how many times a customer has called within a time period. Additionally or alternatively, for example, a cost may be adjusted based on an identified emotion of a speaker. For example, a higher cost may be associated with a given phrase that is identified in a call of a customer who mentions the given phrase and is identified as an angry customer than if the same given phrase is identified in a call of a customer who is not angry. Additionally, for example, a phrase that is mentioned multiple times in a call may be assigned a higher cost to reflect the potential importance of the phrase. The costs in later audio file searches associated with a given phrase may be adjusted based on a particular user just when analyzing audio data of that particular user and/or may be adjusted for all later searches to reflect a new indication of the importance of the phrase in identifying instances where the phrase is spoken.

Phonetic search engine **230** may be utilized to search one or more audio sources **220** and/or one or more audio files saved in audio database **225**. Phonetic search engine **230** may scan one or more audio streams and/or audio files for a particular phrase or phrases received from audio search module **200** and/or audio database **225**. In some implementations, audio search module **200** may associate a threshold probability value to one or more phrases. Phonetic search engine **230** may search one or more audio files and/or streams and flag instances in the audio file where the likelihood that the audio file contains the phrases of interest exceeds a minimum threshold probability. For example, audio search module **200** may request that the phrase "I'd like to cancel my subscription" be located in a given set of audio files. Phonetic search engine **230** may phonetically search the audio files and flag any position in the audio files where phonetic search engine **230** is at least 95% confident that the phrase is present. In

some implementations, phonetic search engine **230** may provide a notification that an audio file contains the phrase without indicating where in the audio file the phrase is located. In some implementations, audio search module **200** may utilize a notification from phonetic search engine **230** to trigger one or more additional events, such as associating the audio file with a pre-defined category and/or term. In some implementations, audio search module **200** may only trigger a notification when a cost associated with a phrase exceeds a threshold. For example, a cost of $0.50 may be associated with the phrase "I'd like to change my service." If $0.50 is below a threshold value for cost, the phrase is less likely to be located in an audio file than if $0.50 were above the threshold value and/or if a greater cost was associated with the same phrase. A notification may be less likely to be sent based on a lower associated cost than an identification of the same phrase with a higher associated cost. Additionally or alternatively, an audio file may contain a reference to a component of a service which is of minimal value. Audio search module **200** may not flag the audio file for further investigation unless the cost of the component is above a critical value. For example, a service may have an additional feature with one version that is an additional $1.99, while another version of the feature costs $19.99. A phrase containing the name of the service may have a larger cost associated with the phrase when a customer has the more expensive version of the service, making it more likely that a potential match will be located in an audio file.

Phonetic search engine **230** may transmit information regarding the location of one or more phrases in a set of audio files to audio search module **200** for further analysis. In some implementations, one or more further events may be triggered by the likely presence of a phrase in an audio file. For example, an audio file may be flagged for further analysis by a supervisor when a phrase categorized as a complaint is likely present in the audio file. In some implementations an audio file may be flagged for further analysis when one or more phrases is absent from an audio file. In some implementations, an audio file may contain two or more phrases of interest, but an event may be triggered only when two or more of the multiple phrases are located within a specified time frame. For example, an audio file may be flagged when the word "dislike" and the name of the company are found in the same audio file. Also, for example, the audio file may only be flagged when the word "dislike" and the name of a company of interest are found in the same audio phrase and co-occurring within a 15-second time interval. Also, for example, the audio file may only be flagged when one or more of the words "dislike", "unhappy", or "upset" and the name of the company of interest are found in the same audio phrase and co-occurring within a 15-second time interval. Additionally or alternatively, a user may have an interest in the co-occurrence of multiple phrases of interest, the occurrence of one phrase of interest and non-occurrence of a second phrase of interest, and/or the non-occurrence of multiple phrases of interest. For example, an audio file which does not contain an instance of the phrase "Your call may be recorded" disclaimer may be flagged. Also, for example, an audio file may be flagged if a phrase is identified that relates to a customer cancelling an account and a customer service representative does not mention the phrase "We value your business."

Referring FIG. **16**A, a block diagram illustrating an example of a scalable distributed computing environment for processing audio data is provided. The communication network **1601**A facilitates communication between the various components in the environment. In some implementations the communication network **1601**A may include the Internet, one or more intranets, and/or one or more bus subsystems. The communication network **1601**A may optionally utilize one or more standard communications technologies, protocols, and/or inter-process communication techniques.

In the illustrated environment, audio source **1645**A may receive streaming audio via a telephonic communication device, such as a landline telephone, through cellular communication, and/or communication network **1601**A. In some implementations, additional audio sources may be utilized to handle streaming audio data generated from incoming calls. Incoming audio streams may be transmitted to one or more slave processors **1615**A, master processor **1600**A, and/or content database **1640**A. Audio source **1645**B may share one or more characteristics with audio sources **220** of FIG. **2**. In some implementations, audio streams received from audio source **1645**A may first be processed by one or more slave processors **1615**A and/or one or more master processor **1600**A. In some implementations, audio streams from audio source **1645**B may be immediately processed by one or more slave processors, processed by one or more master processors **1600**A, and/or stored in database **1640**A by one or more processor. In some implementations, content database **1640**A may share one or more aspects with audio database **225**, database **250**, and/or database **1640**B.

Master processor **1600**A may schedule and coordinate processing tasks for distribution to one or more slave processors. Some systems may include multiple master processors in communication with each other. In some implementations, one master processor **1600**A may be a primary master processor and one or more additional master processors may be secondary master processors and utilized when one or more master processors is offline and/or the processing load on one or more master processors reaches a threshold. In some implementations, multiple master processors **1600**A may be in communication and jointly coordinating task distributions to one or more slave processors **1615**A. Master processor **1600**A may assign computing jobs to one or more slave processors **1615**A. In some implementations, one or more master processors **1600**A may receive notifications from audio source **1645**A via communication network **1601**A that one or more audio streams require processing and instruct one or more slave processors **1615**A to begin processing the streams. Additionally or alternatively, master processors **1600**A may receive analysis and/or processing results from one or more slave processors **1615**A.

In the illustrated environment, the system includes two slave processors **1615**A. Some systems may utilize additional and/or fewer slave processors to process, phonetically translate, index, and/or store audio data and/or metadata associated with audio data received from audio source **1645**A via communication network **1601**A. In some implementations, a system may include multiple slave processors **1615**A and may vary the number of utilized slave processors depending on a computing load to efficiently maintain consistent processing speed. In some implementations, one or more master processors **1600**A may estimate the number of slave processors to utilize based on calculating a load value. In some implementations the load value may be based on one or more factors, such as expected volume of incoming audio streams, historical audio stream volume, density of incoming audio streams, the time of day (e.g., certain times of day may typically see increased call traffic for a call center), day of the week, date of the year, speed and/or capabilities of master and/or slave processors, and/or other factors to indicate the number of slave processors needed to phonetically translate, process, search, index, and/or store audio files. Master processor **1600**A may add additional slave processors **1615**A when a load value exceeds a processing threshold and remove

slave processors **1615**A when a load value is below a processing threshold. For example, one slave processor may process **10** audio streams simultaneously at speed which satisfies a threshold speed. A master processor may add a second slave processor **1615**A if the density of incoming calls increases to 11 and the speed for a single slave to process the audio streams no longer satisfies the threshold speed.

Slave processors **1615**A may process one or more audio streams, search audio files and/or audio streams for phrase occurrences, and/or store audio files. In some implementations, a slave processor **1615**A may perform one or more methods illustrated in FIGS. **3** through **7** and described herein. Master processor **1600**A may assign one or more slave processors **1615**A a task, such as searching an audio file and/or audio stream to identify one or more phrases and/or processing an audio stream to prepare the stream for storage in content database **1640**A. A slave processor **1615** may be instructed by master processor **1600**A to begin or cease processing and/or searching audio files based on a current and/or predicted load value for the system. In other implementations, audio files may be saved in content database **1640**A and master processors **1600**A may direct one or more slave processors **1650**A to retrieve an audio file from content database **1640**A and perform one or more tasks utilizing the file. In some implementations, slave processors **1615**A may share one or more aspects with slave processors **1615**B.

Content database **1640**A may store audio files and/or data files derived from one or more audio streams by one or more slave processors **1615**A and/or master processor **1600**A. In some implementations, content database **1640**A may additionally and/or alternatively store metadata associated with an audio file. In some implementations, the metadata may include one or more determined characteristics of the audio file such as, for example, date when the audio file was recorded, telephone number and/or account number of a customer in a recording, length of an audio file, location of an audio file in memory, and/or search results from one or more phrase searches on the audio file. In some implementations, content database **1640**A may be a remote database and/or may utilize cloud computing to store and/or retrieve audio files. In some implementations, multiple content databases may work in conjunction to store one or more aspects of audio files. For example, one or more databases may be utilized to store metadata associated with audio files, such as timestamps, speaker identification information, and/or phrase search results. In some implementations, content database **1640**A may share one or more aspects with database **250**, audio database **225**, and/or content database **1640**B.

Many other configurations are possible having more or less components than the environment shown in FIG. **16**A. For example, although two slave processors **1615**A are illustrated in FIG. **16**, it is understood that in some environments additional and/or fewer slave processors may be present in some implementations. Also, for example, some implementations may include additional master processors. Also, for example, in some environments audio source may be omitted and audio processing may be performed on audio files provided by content database **1640**A. Also, for example, in some environments one or more of the components may be combined.

Referring to FIG. **16**B, a block diagram illustrating an example environment of a system for analyzing audio data utilizing cloud computing is provided. In some implementations, a system environment may include one or more additional components and/or one or more components depicted in FIG. **16**B may share one or more characteristics with components of the computer architectures illustrated in FIGS. **1**, **2**, and/or **16**A. In the illustrated environment, audio source **1645**B may receive audio via a telephonic communication device, such as a landline telephone, telephone switches, through cellular communication, computer network communication, and/or voice over IP. In some implementations, additional audio sources may be utilized to handle streaming audio data generated from incoming calls. Audio stream queue **1635**B may receive audio streams from audio source **1645** and prepare incoming audio streams for distribution to one or more slave processors. Audio source **1645**B may share one or more characteristics with audio sources **220** of FIG. **2**. In some implementations, audio streams received from audio source **1645**B may first be processed by one or more modules illustrated in FIG. **2**. For example, phonetic search engine **230** may first receive audio streams from audio source **1645**B and digitally transcribe conversations in the audio stream. In some implementations, audio stream queue **1635**B may receive digital representations of analog audio initially received from audio source **1645**B. Audio stream queue **1635**B may organize incoming audio streams from audio source **1645**B and facilitate routing audio streams to one or more slaves for further analysis. In the illustrated environment, audio file cloud **1630**B may be utilized to store audio files in preparation for later routing to one or more slave processors. In some implementations, audio files and associated metadata may be stored in audio file cloud **1630**B in a distributed and balanced manner in order to improve efficiency in audio processing. In some implementations, audio streams from audio source **1645**B may be directed to network switch **1610**B. In some implementations, audio streams from audio source **1645**B may be directly transmitted to audio file cloud **1630**B. Audio streams from audio source **1645**B may be held in audio stream queue **1635**B, stored in audio file cloud **1630**B, immediately processed by one or more slave processors, transferred directly to network switch **1610**B and processed by one or more master processors, and/or stored in database **1640**B by one or more processor. In some implementations, database **1640**B may share one or more aspects with audio database **225** and/or database **250**.

Audio stream data from audio source **1645**B may be accessible to one or more slave processors **1615**B via audio file cloud **1630**B. Three slave processors are depicted in FIG. **16**B, but other implementations may include any number of slave processors based on load value and/or capabilities of the system. For example, a system where thousands of audio files are processed daily may include additional slave processors compared to a system which may process fewer than one hundred calls per day. Slave processors **1615**B may execute one or more methods to phonetically search, translate, index, and/or store one or more audio streams, audio files, and/or audio file fragments. Slave processors **1615**B may receive audio stream data from audio stream queue **1635**B and/or from audio source **1645**B via a network switch **1610**B and/or through audio file cloud **1630**B. Slave processors **1615**B may perform a search on one or more audio files and or audio file fragments for the occurrence of one or more phrases utilizing methods which may share one or more characteristics with the methods illustrated in FIGS. **3** through **7** and described herein.

One or more master processors **1600**B may communicate with slave processors **1615**B via a network switch **1610**B. The system depicted in FIG. **16** illustrates two master processors **1600**B. Other systems may include additional or fewer master processors **1600**B. In some implementations, one master processor **1600**B may be a primary master processor and one or more additional master processors may be utilized as a secondary master processor when the primary master

processor is offline and/or the processing load on one or more primary master processors reaches a threshold. In some implementations, multiple master processors **1600**B may be in communication and jointly coordinating task distributions to one or more slave processors **1615**B. Master processor **1600**B may assign computing jobs to one or more slave processors **1615**B. In some implementations, master processor **1600**B may maintain metadata associated with audio files residing in audio file cloud **1630**B and/or audio files processed by one or more slave processors **1615**B. In some implementations, one or more master processors **1600**B may receive notifications from audio stream queue **1635**B that one or more audio files require processing. For example, a telephone call may be initiated and directed to audio source **1645**B, which may relay the audio stream to audio stream queue **1635**B. Master processor **1600**B may receive a notification that an audio file is waiting in audio stream queue **1635**B and instruct one or more slave processors **1615**B to retrieve the waiting audio file and begin processing the file. Additionally or alternatively, master processors **1600**B may receive analysis and/or processing results from one or more slave processors **1615**B. In some implementations, master processor **1600**B may access one or more audio files and divide a file into smaller fragments and instruct one or more slave processors **1615**B to further process the fragments. For example, master processor **1600**B may receive an audio file which is 300 megabytes. Master processor may split the audio file into three smaller segments of 100 megabytes each and transmit the first segment to the first slave processor **1615**B, the second segment to the second slave processor, and the last segment to the third slave processor. Each slave processor may perform one or more methods using a segment of the audio file and transmit audio search results to master processor **1600**B for further processing. Additionally or alternatively, master processor **1600**B may instruct one or more slave processors **1615**B to fragment one or more audio files for further processing by one or more additional slave processors **1615**B.

In some implementations, slave processors **1615**B may process audio files and/or perform searches of audio files in real time. Master processor **1600**B may assign one or more slave processors **1615**B to perform a search on an audio file and/or audio stream as it is being relayed to the slave processor **1651**B. In other implementations, audio files may be saved in database **1640**B and master processors **1600**B may instruct one or more slave processors **1615**B to retrieve an audio file from database **1640**B at a later time.

Referring to FIG. **3**, a flow chart of an embodiment of a method of analyzing audio and text files to refine search terms is illustrated. Other implementations may perform the steps in a different order, omit certain steps, and/or perform different and/or additional steps than those illustrated in FIG. **3**. For convenience, aspects of FIG. **3** will be described with reference to a system of one or more components that perform the process. The system, for example, may include one or more components of the systems illustrated in FIG. **1** and FIG. **2**.

At step **300**, one or more audio files are received by the system. The audio files may be in the form of a digital representation of audio, such as, for example, a ".wav" file or MP3 file. In some implementations, the audio file may be further processed in order to assist the system in further analysis. For example, an audio file may be received and smaller audio segments may be generated based on the received audio file. An audio segment may be a continuous period of a larger audio file (e.g., a continuous 15 second interval) or may comprise multiple periods of a larger audio file (e.g., the first 15 seconds and the last 15 seconds). In some implementations, audio files may be provided to the system in the form of a text file and/or associated with a text file, where the text file contains a transcript of all or portions of an audio file. In some implementations, step **300** may be performed utilizing a module that shares one or more aspects with phonetic search engine **230**.

At step **305**, text files are received for determination of potential search phrases which may be present in the received text files. The received text files may include contents of emails, contents of documents, user created documents, customer created documents, and/or content from websites. In some implementations text files received at step **305** may be analyzed utilizing a module which shares one or more aspects with text mining engine **210**. In some implementations, text files received at step may be transmitted from database **250** and/or external text sources **255**. In some implementations, the system may access search phrases which were previously derived from one or more text files. For example, the search phrases may be stored in database **250** having a plurality of search phrases that have been determined to be important search phrases for a particular audio file received at step **300**. In some implementations the identified search phrases may be particular to the type of audio file received at step **300**. For example, one or more phrases may be identified with audio files received at step **300** pertaining to cell phone service provider service representatives and a second set of phrases may be identified from another index when audio files pertain to an insurance carrier service representative. In some implementations, the system may not perform step **305**.

At step **310**, the system receives search terms from a user. The user may manually input search phrases, terms, and/or categories of phrases based on one or more phrases which the user has interest in finding in one or more audio files. The user may input search terms utilizing one or more graphical user interfaces which may share one or more characteristics with the graphical user interface illustrated in FIG. **11**. In some implementations the user may input search terms using an audio input such as a microphone and/or using another user interface. In some implementations, step **310** may not be performed.

At step **315**, the audio files received at step **300** are analyzed based on search parameters received at step **310** and/or derived from text files received at step **305**. In some implementations, step **315** may be performed by a module which shares one or more characteristics with phonetic search engine **230** and/or by audio search module **200**. In some implementations, audio is analyzed via text transcriptions of audio previously generated by one or more modules. At step **315**, one or more audio files are searched for the presence of the search terms or phrases which have been indicated. In some implementations, results of step **315** may be utilized to trigger one or more notifications based on the presence or absence of the search parameters.

At step **320**, the audio files may be further analyzed to determine whether new search terms may be generated from the content of the audio files. In some implementations, step **320** may include suggesting refinements to one or more search phrases which were received at step **310**. In some implementations, new search terms or phrases may be generated based on the contents of the audio files. For example, multiple instances of an additional phrase that was not initially searched for may indicate that the new phrase may be significant. Based on the co-occurrence of a potential new search term and one or more terms which were received at step **310**, a new association may be constructed based on the co-occurrence of the new phrase and a previous search term. For example, while searching an audio file for the phrase

"upset with my service," the phrase "cancel my service" may be identified multiple times in the searched audio file. A new association between the new phrase and the previous search phrase may be identified for future searches.

At step **325**, the search phrases of step **310** are refined based on information provided in step **305**, step **310**, and/or step **320**. Audio search module **200** may associate new search phrases with existing search phrases, alter existing search phrases, and/or eliminate one or more search phrases based on information provided at step **305**, **310**, and/or **320**. For example, the system may receive the search phrase "cancel my account" from a user at step **310**. After analysis at step **315** and review of the analysis at step **320**, the system may find instances where both "I'd like to" and "Do not" appear in close proximity to "cancel my account." Because the co-occurrence of each of those terms with "cancel my account" may identify audio files which are likely to result in different outcomes, the system may suggest new phrases, such as "I'd like to cancel my account" and "Do not cancel my account." The system may additionally or alternative suggest eliminating the phrase "cancel my account" from prospective search phrases. Additionally, for example, the system may not find occurrences of the phrase "I'd like to cancel my account" but may find multiple instances of the phrase "I would like to cancel my account." The system may associate the two phrases together into a single term so that, when "I'd like to cancel my account" is chosen as a search phrase, the system may associate the phrase "I would like to cancel my account" as an additional acceptable match to the search phrase. The refined search phrases may then be utilized by the system to search further received audio files.

In some implementations, the steps of the method illustrated in FIG. **3** may be performed utilizing a system which shares one or more characteristics with the system illustrated in FIG. **2**. In some implementations, analysis of audio files for potential matches to a key phrase may be executed utilizing a module which may share one or more characteristics with phonetic search engine **230** and/or emotion recognition engine **235**. In some implementations, decisions on potential search phrases from text files may be suggested utilizing a module which shares one or more characteristics with text mining engine **240**. In some implementations, decisions on including new search phrases, altering previous search phrases, and/or eliminating previous search phrases may be processed utilizing a module which shares one or more characteristics with data mining engine **240**. In some implementations, a user may additionally or alternatively enter search phrases of interest utilizing a remote computing processor which may share one or more characteristics with workstation **270**.

Referring to FIG. **4**, a flowchart of an embodiment of a method for searching an audio file for one or more key phrases of interest is illustrated. Other implementations may perform the steps in a different order, omit certain steps, and/or perform different and/or additional steps than those illustrated in FIG. **4**. For convenience, aspects of FIG. **4** will be described with reference to a system of one or more components that perform the process. The system, for example, may include one or more components of the systems illustrated in FIG. **1** and FIG. **2**.

At step **400**, an audio segment is received by the system. The audio segment may be an audio file generated based on a phone conversation between a customer and a customer service representative. In some implementations, the audio segment received at step **400** may be a complete conversation. The audio file segment received at step **400** may be a fragment of a larger audio file. In some implementations, step **400** may be executed utilizing a module which shares one or more characteristics with audio search module **200**. In some implementations step **400** may share one or more aspects with step **300** of FIG. **3**.

At step **405**, the system receives a phrase of interest. The phrase may include one or more words which a user has interest in locating and one or more audio segments. In some implementations, step **405** may include receiving multiple phrases. The user may have an interest in the co-occurrence of multiple phrases, the occurrence of one phrase and non-occurrence of a second phrase, and/or the non-occurrence of multiple phrases. A phrase of interest received at step **405** may be associated with a cost **415**. In some implementations, the cost **415** associated with the phrase of interest may share one or more characteristics with the cost as previously described herein. In some implementations steps **300**, **305**, and **310** of FIG. **3** may share one or more common aspects with step **405**.

At step **410**, the audio segment received at step **400** is analyzed and a phrase in the audio segment is identified as a potential match to the phrase of interest from step **405**. An audio file search may include direct analysis of an audio stream and/or analysis of metadata associated with an audio file, such as a text transcription. In some implementations, an audio file may be searched utilizing a phonetic analysis engine which may share one or more characteristics with phonetic search engine **230**. In some implementations, phrases may be compared textually based on one or more criteria, such as the number of words shared by the phrases, the number of words between shared words of the phrases, the distance between shared words, a threshold of matching words, and/or an exact match between phrases. For example, the phrase "Cancel my subscription now" may be identified as a match to the search phrase "cancel monthly subscription" based on the criteria that the phrase shares at least two words with the search phrase, common words between the phrases are less than two words apart in the phrase, and/or the phrase contains more than 50% of the words in the search phrase. Also, for example, the phrase may not be a potential match if the search criterion requires exact matching between a phrase and the search phrase.

At step **420**, a confidence level is determined based on the phrase of interest and the phrase identified at step **410**. The confidence level determined at step **420** may reflect the likelihood that the phrase identified in step **410** matches the phrase of interest received at step **405**. In some implementations, the confidence level may be represented as a percentage, as a decimal value, and/or as a real number. In some implementations, the confidence level determined at step **420** may additionally utilize cost **415**. For example, the confidence level of a potential match to a phrase which may result in a monetary loss to a company, such as "I'm cancelling my account," may be adjusted to a level more likely to satisfy a threshold when a company may incur a significant cost if a caller cancels services. In some implementations, step **420** may be executed utilizing one or more modules which may share characteristics with audio search module **200** of FIG. **2**.

At step **425**, the system receives a threshold confidence level. A threshold confidence level may be assigned to one or more phrases based on data which may share characteristics with user input via workstation **270**, external text sources **255**, database **250**, audio database **225**, and/or one or more computing modules. Also, for example, the system may determine a threshold confidence level based on one or more factors, such as cost associated with a phrase, customer account information, and/or associated emotion recognition data. For example, the system may additionally receive emotion rec-

ognition data that identifies the speaker is angry. The system may determine a threshold confidence level that is more likely to be satisfied for phrases related to "Account Cancellation Reasons" to reduce the likelihood that an instance of a phrase related to account cancellations was missed during the investigation of the phrase. Also, for example, the system may determine a threshold confidence level that is more likely to be satisfied when the cost associated with a phrase is significant, such as when the cost represents a monetary loss to a company.

At step **430**, the system may send a notification based on the threshold confidence level received at step **425** and the confidence level determined at step **420**. In some implementations, a notification at step **430** will be sent when the confidence level determined at step **420** satisfies the threshold confidence level received at step **425**. In some implementations, the notification sent at step **430** may trigger one or more subsequent events **435**. For example, the notification of step **430** may trigger the marking of the audio file segment received at step **400** for further review when a match to the phrase of interest in step **405** was identified with a confidence level at step **420** that satisfies the threshold confidence level received at step **425**. Also, for example, a notification may trigger an e-mail, text, and/or other message to a supervisor. The notification at step **430** may include information regarding whether an identified phrase in the audio segment exceeds the given minimum confidence level, the location within the audio file of the identified phrase, and/or information regarding the cost **415** associated with the phrase of interest. In some implementations, the notification of step **430** may trigger the alteration of one or more search phrases, utilizing a method which may share one or more characteristics with step **325**.

Referring to FIG. **5**, a flowchart of an embodiment of a method for searching an audio file for one or more key phrases of interest and triggering a subsequent event is illustrated. Other implementations may perform the steps in a different order, omit certain steps, and/or perform different and/or additional steps than those illustrated in FIG. **5**. For convenience, aspects of FIG. **5** will be described with reference to a system of one or more components that perform the process. The system, for example, may include one or more components of the systems illustrated in FIG. **1** and FIG. **2**.

At step **500**, a phrase of interest is received by the system along with the cost associated with the phrase of interest. At step **505**, an audio file is analyzed for the presence of the phrase of interest. In some implementations, the procedure for identifying a potential match to the phrase of interest may share one or more characteristics with steps **315** and/or **410**. At step **510**, the system generates a notification. The notification of step **510** may be utilized to trigger one or more subsequent events. In some implementations, notification **510** may trigger a subsequent event **520** when the cost associated with the phrase of interest exceeds a given threshold value. For example, the cost associated with phrase of interest may be a monetary amount. If the monetary amount exceeds a threshold amount, the system may alert the user of the potential loss of revenue and may optionally identify the particular estimated amount of loss of revenue. The cost threshold utilized by the system to determine whether a notification triggers a subsequent event may affect the confidence level to which a potential match to a phrase of interest is measured. For example, if the cost associated with a phrase of interest is significant, a potential match in an audio file to the phrase of interest may require a lower threshold to ensure that a potential significant monetary loss is not incurred without an event being triggered. Based on the associated costs, a user may have a higher tolerance for false-positive identifications then for false-negative identifications. In some implementations, the event triggered at step **520** may include adjusting the cost associated with the phrase of interest based on analysis results from step **505** and executing the method on one or more additional audio files.

Referring to FIG. **6**, an embodiment of a method to search audio files for the co-occurrence of two phrases is illustrated. Other implementations may perform the steps in a different order, omit certain steps, and/or perform different and/or additional steps than those illustrated in FIG. **6**. For convenience, aspects of FIG. **6** will be described with reference to a system of one or more components that perform the process. The system, for example, may include one or more components of the systems illustrated in FIGS. **1** and **2**.

At step **600**, the system receives a maximum time interval. The maximum time interval may represent the maximum allowable time between two potential matches for two given key phrases. At step **605**, the system receives a potential match location to a first key phrase in an audio file. At step **610**, the system receives a location of a potential match to a second key phrase in the audio file. Step **605** and step **610** may optionally share one or more aspects with one or more with steps **320**, **410**, **420**, and/or **505**. Additionally or alternatively, the first key phrase and/or the second key phrase may be associated with one or more costs and/or threshold confidence levels for the probability that a potential match to a phrase in an audio file is the phrase of interest. At step **615**, the system compares an identified confidence level that the potential match to the second key phrase meets the given threshold confidence. At step **620**, the system compares an identified confidence level of the potential match of the first given key phrase to the location in the audio file. If the identified confidence level for the potential match for the first given key phrase does not meet a given threshold confidence level and/or if the identified confidence level for the potential match for the first given key phrase does not meet a given threshold confidence level, the system proceeds to step **635** and does not send a notification. If both the first potential match and the second potential match meet a threshold confidence level, the system may further compare the locations of the first potential match and the second potential match to each other at step **625**. If the location between the first potential match and the second potential match does not exceed the maximum time interval received at step **600**, the system may send a notification **630**. For example, the maximum time interval value received at step **600** may be 30 seconds. The maximum time interval of 30 seconds is the maximum time on the audio file between which the phrases received at step **605** and **610** may be located in order for the system to issues a notification. If the first potential match to the first phrase and the second potential match to the second phrase are 15 seconds apart on the audio file, the system will issue a notification. If the phrases are 100 seconds apart, the system will not issue a notification. In some implementations, the notification of step **630** may trigger one or more subsequent events. In some implementations, the absence of the notification as illustrated in step **635** may trigger one or more subsequent events. For example, the notification of step **630** may trigger the flagging of the audio file, an email may be sent to a supervisor, and/or an interface may display one or more aspects of the audio file. Additionally or alternatively, the occurrence of two given key phrases outside of the maximum time interval of step **600** may trigger a notification. For example, a company may be interested in customer service calls which last longer than five minutes. The phrases "Hello" and "Have a nice day" may be phrases of interest as audio markers of the start and end of a phone call. A maximum time

interval of five minutes may send a notification when an audio file contains the two phrases and they occur more than five minutes apart.

Referring to FIG. **7**, a flowchart of an embodiment of a method for using distributed computing processors to locate one or more key phrases in an audio file is illustrated. Other implementations may perform the steps in a different order, omit certain steps, and/or perform different and/or additional steps than those illustrated in FIG. **7**. For convenience, aspects of FIG. **7** will be described with reference to a system of one controller **700** and two slave devices **705** and **710** that perform the process. In some implementations, one or more additional controllers and/or slave devices may be utilized to perform the steps of the illustrated method. The system, for example, may include one or more components of the systems illustrated in FIGS. **1**, **2**, and **16**.

At step **715**, controller **700** receives an audio file, a phrase of interest, and a threshold value of the likelihood that a location in the audio file matches the phrase of interest. In some implementations, the procedure for receiving an audio file, phrase of interest, and/or threshold value may share one or more characteristics with step **300** and/or step **400**. In some implementations, step **715** may additionally include receiving a cost associated with the phrase of interest as illustrated in FIG. **4** and described herein. The cost may be used, for example, to determine whether there is a match between a given phrase and a potential match in an audio file to affect the threshold confidence level associated with the phrase, and/or trigger an event based on cost.

At step **720**, the audio file received at step **715** is divided into smaller audio file segments. In some implementations, the controller may receive multiple audio files at step **715** and the audio file segments generated at step **720** may be comprised of the entirety of one or more audio files. At step **725**, audio file segments generated in step **720** are transmitted to slave **705** and slave **710** for further analysis. In some implementations, slaves **705** and **710** may receive one or more complete audio files from controller **700**.

At steps **740** and **745**, slave **705** and slave **710** analyze the segments received from controller **700**. In some implementations, step **740** and **745** may include one or more methods which share one or more characteristics with the methods described in FIGS. **3** through **6** and described herein. For example, slave **705** and/or slave **710** may search one or more given audio files for the occurrence and/or non-occurrence of one or more phrases, identify the occurrence or non-occurrence of phrases based on a maximum or minimum time interval, and/or determine the probability of a match to a position in an audio file based on a given cost and/or threshold confidence level. After slave **705** and slave **710** analyze the respective audio segments, analysis results may be transmitted to controller **700** for further analysis. In some implementations, the analysis results from slave **705** and slave **710** may share one or more characteristics with a notification as described herein.

At step **735**, controller **700** combines the resulting notifications from slave **705** and slave **710** into an aggregate notification. The aggregate notification generated in step **735** may combine one or more aspects of the notifications generated by slave **705** and slave **710**. In some implementations, notifications from slave **705** and/or slave **710** may be utilized to trigger one or more additional events. At step **730**, controller **700** provides the aggregate notification to one or more subsequent systems. For example, the aggregate notification provided in step **730** may be utilized to further adjust a cost associated with the phrase of interest received at step **715**, refine one or more phrases of interest received at step **715**, and/or notify one or more systems that controller **700** is free to process additional audio files.

Referring to FIG. **8**, an example graphical user interface for selecting search terms that may be implemented in an embodiment of an audio file search engine is illustrated. In some implementations, one or more elements of the graphical user interface of FIG. **8** may be absent. In some implementations, the graphical user interface may contain one or more additional elements. For example, the graphical user interface of FIG. **8** may additionally include information regarding associated costs and/or confidence level thresholds associated with one or more key phrases. The graphical user interface of FIG. **8** may be implemented utilizing one or more applications executing on workstation **270**.

Key phrases **800** may be text representations of one or more phrases of interest to be utilized to search one or more audio files. In the illustrated example, key phrases **800** may be generated by a user and/or generated utilizing one or modules as described herein. For example, one or more key phrases **800** may be generated utilizing phonetic search engine **230**, text mining engine **245**, and/or one or more additional modules executing in audio search module **200**. In some implementations, one or more key phrases **800** may be generated utilizing procedures which may share one or more steps with the methods illustrated in the flowcharts of FIGS. **3** through **6** and described herein.

For each key phrase **800**, a user may have one or more actions available to further investigate and/or alter a key phrase **800**. Edit button **805** may allow a user to alter and/or update a key phrase **800**. For example, edit button **805** may direct a user to an editing page where the user may edit one or more characteristics of the identified key phrase **800**, such as cost associated the key phrase, an associated confidence level to be used as a minimum threshold value when an audio file is searched for the key phrase, and/or adding or eliminating one or more words from the phrase. View button **710** may direct the user to a page where the user may view one or more aspects of a key phrase **800**. The user may view an associated cost, an associated threshold confidence level, and/or one or more additional aspects of an identified key phrase. Delete button **815** may be utilized to eliminate one or more key phrases **800** from future searches. For example, "cancel my account" key phrase may no longer be a valid search term. A user may activate the delete button **815** associated with the key phrase **800**, which may eliminate the key phrase from future searches.

Referring to FIG. **9**, an example graphical user interface for displaying a search phrase hierarchy that may be implemented in an embodiment of an audio file search engine is illustrated. In some implementations, one or more elements of the graphical user interface of FIG. **9** may be absent. In some implementations, the graphical user interface may contain one or more additional elements. The graphical user interface of FIG. **9** may be implemented utilizing one or more applications executing on workstation **270**.

Term column **900** displays general definitions of one or more phrases displayed in phrase column **905**. For each term in term column **900**, one or more phrases may be associated with the term. Phrases in phrase column **905** may be variations of speech which are generally covered by the associated term in term column **900**. For example, the first term in term column **900** is "get monthly pass mailed in time." Six phrases have been associated with that term and each of the six phrases are potential variations that may be recognized in an audio file and which have the same essential meaning as the associated term in term column **900**. The term "we will send the monthly pass to you in time" may reflect the same mean-

ing as the term "get monthly pass mailed in time." Likewise, the phrase "we can send monthly pass to you in time" may share a similar meaning with the first phrase and may be identified as having the same meaning as the associated term in term column **900**. In some implementations identification of similar meanings between two or more phrases may be based on determined confidence levels between the two or more phrases. For example, confidence levels may be determined utilizing step **425** and the phrases may be grouped into the same term based on such determination. For each term in term column **900**, one or more actions may be executed to vary and/or alter a term name, a phrase associated with the term name, and/or one or more threshold values associated with a term and/or a phrase (e.g., threshold confidence level, cost). Edit button **910** may allow a user to edit one or more phrases, add one or more phrases, delete one or more phrases, edit one or more values associated with a phrase, edit a term name, alter a term name, and/or edit one or more values associated with a term. Delete button **915** may be utilized to delete a term from term column **900**. View button **920** may be utilized to examine one or more additional values associated with a term in the corresponding term column **900**. Phrases in phrase column **905** may share one or more characteristics with phrases in phrase column **800** as illustrated in FIG. **8** and described herein. In some implementations, view button **920** and/or edit button **910** may direct the user to a page which shares one or more characteristics with the display illustrated in FIG. **8**.

Referring to FIG. **10**, an example graphical user interface for displaying a search term hierarchy that may be implemented in an embodiment of an audio file search engine is illustrated. Other implementations may have one or more components in different configurations, omit certain components, contain additional components, and/or one or more components may perform different and/or additional tasks than those illustrated in FIG. **10**. For convenience, aspects of FIG. **10** will be described with reference to a system of one graphical interface. In some implementations, the graphical interface displaying the graphical user interface of FIG. **10** may share one or more aspects with workstation **270** as illustrated in FIG. **2** and described herein. The graphical user interface FIG. **10** may be generated by system which may share one or more characteristics and/or may include one or more components of the systems illustrated in FIGS. **1** and **2**. Edit button **1010** may allow a user to edit one or more terms, add one or more terms, delete one or more terms, edit one or more values associated with a term, edit a term and/or category name, and/or edit one or more values associated with a category. Delete button **1015** may be utilized to delete a category from category column **1000**. View button **1020** may be utilized to examine one or more additional values associated with a category in the corresponding category column **1000**. Terms in term column **1005** may share one or more characteristics with terms in term column **900** as illustrated in FIG. **9** and described herein. In some implementations, view button **1020** and/or edit button **1010** may direct the user to a page which shares one or more characteristics with the display illustrated in FIG. **9**. Entries in category column **1000** may represent one or more general categories to which terms may be grouped. Entries in term column **1005** may represent one or more terms which have been associated with a corresponding category listed in category column **1000**. Terms in term column **1005** may share one or more aspects with terms listed in term column **900**.

Referring to FIG. **11**, an example graphical user interface for inputting search terms that may be implemented in an embodiment of an audio file search engine is illustrated. Other implementations may have one or more components in different configurations, omit certain components, contain additional components, and/or one or more components may perform different and/or additional tasks than those illustrated in FIG. **11**. For convenience, aspects of FIG. **11** will be described with reference to a system of one graphical interface. In some implementations, the graphical interface displaying the graphical user interface of FIG. **11** may share one or more aspects with workstation **270** as illustrated in FIG. **2** and described herein. The graphical user interface FIG. **11** may be generated by a system which may share one or more characteristics and/or may include one or more components of the systems illustrated in FIGS. **1** and **2**.

The search term interface **1100** may enable the user to specify terms and/or phrases to be used as search parameters in an audio file search engine. In some implementations, search term interface **1100** may be presented to a user in response to user activating an "edit" button illustrated in previous figures. For example, search term interface **1100** may be displayed when user selects edit button **1010** of FIG. **10**, edit button of FIG. **9**, and/or edit button **805** of FIG. **8**. In some implementations, search term interface **1100** may be displayed as a pop-up display when one or more options are selected on one or more additional graphical user interface screens.

Text box **1105** may enable a user to enter one or more search phrases to be utilized in searching audio files. The user may enter a sentence, a sentence fragment, and/or one or more additional characters into text box **1105**. For example, a user may have interest in audio files which contain the words "cancel my account." The user may enter the phrase "cancel my account" into the search field and activate button **1122** to submit the sentence fragment to the search engine. A user may additionally enter one or more phrases simultaneously into text box **1105** to be utilized to search audio files for each phrase individually, the co-occurrence of multiple phrases, the occurrence of one or more phrases with the non-occurrence of one or more phrases, and/or the nonoccurrence of multiple phrases. For example, a second phrase "too expensive" may be entered into text box **1105**. Multiple phrases may be delineated based on one or more characters with particular significance. For example search terms may be delineated by a semicolon, a comma, quotation marks surrounding a search phrase, and/or one or more additional phrase separator characters.

Set selection buttons **1125** may be utilized to select one or more groups of audio files to be searched utilizing the audio file search engine. Selected set display **1110** may display one or more optional sets which may be selected using set selection buttons **1125**. In some implementations, one or more audio file sets selected with set selection buttons **1125** may be used with phrase inputs in text box **1105** to perform a search when button **1120** is activated. In one or more implementations, activating a search using button **1120** may result in displaying one or more graphical user interfaces which may share one or more aspects with the results graphical user interfaces illustrated in FIGS. **12** through **15** and described herein.

Referring to FIG. **12**, an example graphical user interface for a bar graph to display information regarding the presence of phrases in audio files which may be implemented in an embodiment of an audio file search engine is illustrated. For convenience, aspects of FIG. **12** will be described with reference to a system of one graphical interface. In some implementations, the graphical interface displaying the graphical user interface of FIG. **12** may share one or more aspects with workstation **270** as illustrated in FIG. **2** and described herein.

The graphical user interface of FIG. **12** may be generated by a system which may share one or more characteristics and/or may include one or more components of the systems illustrated in FIGS. **1** and **2**.

Bar graph **1220** is an illustration of an example result from a search of one or more audio files. On the illustrated bar graph, the height of bars represents a number of audio files which contain a category of interest. Each bar on bar graph **1220** may represent a category of phrases which were used as search parameters in a search of audio files. Legend **1225** associates each bar in bar graph **1220** with a specific category. For example, the first bar in bar graph **1220** is depicted with the same shade as the square next to the category "cancellation reasons" in legend **1225**. In the illustrated implementation, the units for the y-axis of bar graph **1220** are the number of audio files which contain matches to the corresponding category. Barograph **1220** illustrates that six audio files contain phrases associated with the category "cancellation reasons." The remaining bars in bar graph **1220** have a height corresponding to one audio file for each category. In some implementations, the x- or y-axis may have different units and/or may display additional or alternative information. For example, each bar in bar graph **1220** may represent a set of terms and/or a set of phrases as previously described. The y-axis may measure the height of bars with alternative units, such as percentage of audio files containing phrases from a category, instances of matches to search phrases, and/or a count of audio files which did not contain matches to one or more phrases associated with the term or category.

In some implementations, bar graph **1220** may be utilized to represent confidence levels and/or costs associated with potential matches to key phrases in one or more audio files. For example, each bar in bar graph **1220** may represent a particular key phrase. The height of each bar may be related to a measurement of the confidence level that one or more audio files of interest contain the corresponding key phrase. As described herein, the confidence level may take into account one or more identified characteristics such as, for example, associated costs, customer account information, and/or emotion recognition data. In some implementations, one or more audio files may be investigated for a particular set of key phrases and each bar may represent an aggregate confidence level of the presence of particular key phrases in the set of audio files. Additionally or alternatively, each bar may represent a category of phrases and the height of each bar may represent the likelihood that one or more of those phrases is present in one or more investigated audio files. In some implementations, each bar may represent a cost for a given set of categories or phrases. For example, a bar graph representing "Account Cancellation" may include aggregate sums of the costs of matches to the terms in the category, such as "Too expensive," "Do not like billing system," and/or "Do not like the service."

Call information area **1210** may display one or more pertinent characteristics of audio files used in a phrase search. In the illustrated implementation, call information area **1210** includes a set of dates which may represent a time interval from which all audio files contained in the search were initially recorded. Channel type may describe the particular voice stream from an audio file which was utilized during an audio search. For example, a phone call between two callers may contain 2 channels: one for each speaker in the call. The user may select one or more channels contained in an audio file be used in an audio search. In some implementations, call information area **1210** may contain information regarding categories, terms, and/or search phrases which were used as parameters in a search of audio files.

Filter area **1205** may list one or more filters which were utilized to filter one or more aspects of search results from being included in bar graph **1220**. In the illustrated example, a filter is set to display a bar graph where each bar represents a category. In some implementations, a filter may be activated which categorizes and displays bars based on groups of search terms and/or specific phrases. For example, a filter may be activated which displays each bar as a term contained within a specified category.

Graph selection area **1215** may display thumbnail versions of one or more additional and/or alternative displays for search result information. In some implementations, individual images in graph selection area **1215** may be smaller versions of more search result interfaces illustrated in FIGS. **13** through **15** and described herein. In one or more implementations, additional or alternative display options may be displayed in graph selection area **1215**, such as a pie graph. In some implementations, one or more images in graph selection area **1215** may be clickable and when activated, may direct the user to one or more additional and/or alternate display pages which may share one or more characteristics with the displays illustrated in FIGS. **13** through **15** and described herein.

Referring to FIG. **13**, an example graphical user interface for a word cloud to display information regarding the presence of phrases in audio files which may be implemented in an embodiment of an audio file search engine is illustrated. For convenience, aspects of FIG. **13** will be described with reference to a system of one graphical interface. In some implementations, the graphical interface displaying the graphical user interface of FIG. **13** may share one or more aspects with workstation **270** as illustrated in FIG. **2** and described herein. The graphical user interface of FIG. **13** may be generated by a system which may share one or more characteristics and/or may include one or more components of the systems illustrated in FIGS. **1** and **2**.

Word cloud **1320** is an illustration of an example result from a search of one or more audio files. In the illustrated display, the font size may represent the number of audio files which contain one or more phrases associated with a category. In some implementations, the font size may represent the number of occurrences of phrases associated with a category, the frequency of occurrences of phrases associated with a category, a cost associated with phrases in one or more categories, and/or a confidence level of phrase matches in one or more audio files. Each set of words in word cloud **1320** may represent a category of phrases which were used as search parameters in a search of audio files. For example, the phrase "Agent Behaviors" is depicted in a larger font than the remaining phrases. The largest font size may be indicative of a search which resulted in locating phrases within the category "Agent Behaviors" more than phrases in the remaining categories. Phrases that may be included in the category "Agent Behaviors" include, for example, "Thank you for calling," "We have a new promotional offer," and/or "This call may be monitored." The remaining phrases in word cloud **1320** may have a font size in proportion with other phrases in the cloud based on the relative counts of audio files containing phrases associated with respective categories. In some implementations, the sets of words in word cloud **1320** may represent additional or alternative groupings of phrases. For example, the sets of words in word cloud **1320** may be a terms associated with a particular category, such as the terms listed in term column **1005** in FIG. **10** and/or in term column **9005** of FIG. **9**. Additionally, the font size may represent alternative units, such as percentage of audio files containing phrases from a category, account of instances of matches to search

phrases in one or more audio files, and/or a count of audio files which did not contain matches to one or more phrases associated with a term or category.

In some implementations, word cloud **1320** may be utilized to represent confidence levels of potential matches to key phrases in one or more audio files. For example, each word in word cloud **1320** may represent a particular key phrase. The font size of each word may be related to a measurement of the confidence level that an audio file of interest contains the written phrase. As described herein, the confidence level may take into account one or more identified characteristics such as, for example, associated costs, customer account information, and/or emotion recognition data. In some implementations, one or more audio files may be investigated for a particular set of key phrases and each set of words may represent an aggregate confidence level of the presence of particular key phrases in the set of audio files. Additionally or alternatively, each set of words may represent a category of phrases and the font size for each set of words may represent the likelihood that one or more of those phrases is present in one or more investigated audio files. In some implementations, a word cloud may represent costs for a given set of categories or phrases. For example, font size in a word cloud for the set of words "Account Cancellation" may represent a sum of the costs of matches to all terms and/or phrases in the corresponding category, such as "Too expensive," "Do not like billing system," and/or "Do not like the service." In some implementations, one or more audio files may be investigated for particular set of phrases and the font size of each set of words may represent a confidence level of the presence of the corresponding written phrase in the investigated audio files. Additionally or alternatively, each set of words in word cloud **1320** may represent a category of phrases and the font size of each phrase may represent the likelihood that one or more phrases associated with the respective category is present in one or more of the investigated audio files.

Call information area **1310** may display one or more characteristics of audio files used in a phrase search. In the illustrated interface, call information area **1310** includes a set of dates that may represent a time interval from which all audio files contained in a search were initially recorded. Channel type may describe a particular voice stream from an audio file which was utilized during a phrase search. For example, a phone call between two callers may contain two channels: one for each speaker in the call. The user may select one or more channels contained in an audio file to be used in a search with given key phrases. In some implementations, call information area **1310** may contain additional and/or alternate information regarding categories, terms, and/or search phrases which were used as parameters in a search of audio files. In some implementations, one or more components may be absent from call information area **1310**.

Filter area **1305** may list one or more filters that have been utilized to filter one or more aspects of the search result from being included in word cloud **1320**. In the illustrated example, a filter is set to display a word cloud where each set of words in word cloud **1320** represents a category. In some implementations, a filter may be activated which categorizes and displays phrases based on groups of search terms and/or specific phrases. For example, a filter may be activated which displays phrases and each phrase corresponds to a term contained within a specific category.

Graph selection area **1315** may display thumbnail versions of one or more additional and/or alternative displays for search result information. In some implementations, individual images in graph selection area may be smaller versions of more search result interfaces illustrated in FIGS. **12** through **15** and described herein. In one or more implementations, additional or alternative display options may be displayed in graph selection area **1315**, such as a pie graph. In some implementations, one or more images in graph selection area **1315** may be clickable and when activated, may direct the user to one or more additional and/or alternate display pages which may share one or more characteristics with the displays illustrated in FIGS. **12** through **15** and described herein.

Referring to FIG. **14**, aspects of an example trend graph graphical user interface to display information regarding the presence of particular search phrase categories in multiple audio files which may be implemented in an embodiment of an audio file search engine is illustrated. For convenience, aspects of FIG. **14** will be described with reference to a system of one graphical interface. In some implementations, the graphical interface displaying the graphical user interface of FIG. **14** may share one or more aspects with workstation **270** as illustrated in FIG. **2** and described herein. The graphical user interface of FIG. **14** may be generated by a system which may share one or more characteristics and/or may include one or more components of the systems illustrated in FIGS. **1** and **2**.

Trend chart **1420** may represent results from an audio file search utilizing one or more phrases. In trend chart **1420**, the x-axis may represent a time interval. For example, the x-axis of trend chart **1420** displays a series of dates corresponding to the dates when audio files were initially recorded. In the illustrated trend chart **1420**, the y-axis displays the number of calls where a search identified one or more phrases associated with a category. Trend line **1440** connects points on trend chart **1420** where results from searches using the same search phrases on different sets of audio files are plotted. For example, data point **1430** represents the result of a search conducted on audio files from Apr. 15, 2011, for phrases associated with "Cancellation Reasons," which resulted in identifying phrases in six audio files. Data point **1435** represents the result of a search conducted on audio files from Apr. 17, 2011, for phrases associated with the same category, which resulted in identifying phrases in zero audio files. Trend line **1440** connects the data point **1430** and the data point **1435**. In some implementations, lines of differentiating color may represent search results from multiple categories on the same date range of audio files. In the illustrated interface, two trend lines of differing shades are displayed on trend chart **1420**, each representing a category. The coloring of lines on trend chart **1422** may correspond to one or more labels illustrated in legend **1425**. In some implementations, legend **1425** may associate trend chart colors with one or more categories, terms, sets of phrases, and/or search phrases.

In some implementations, trend chart **1420** may be utilized to represent confidence levels of identified matches to key phrases in one or more audio files. For example, the y-axis may be a measurement of confidence levels that a phrase was found in a search. As described herein, the confidence level may take into account one or more identified characteristics such as, for example, associated costs, customer account information, and/or emotion recognition data. In some implementations, one or more audio files may be investigated for a set of phrases and data points on the graph may represent confidence levels that one or more phrase in the set are located in the investigated audio files from the corresponding time period. Additionally or alternatively, data points may represent the results of searches based on a category of phrases where the coordinates of data points may represent the likelihood that one or more of the phrases associated with the category are present in audio files recorded at a corresponding

time. In some implementations, each data point may represent a cost for a given set of categories or phrases. For example, a trend chart representing "Account Cancellation" may include a sum of the costs associated with all matches to the terms in the category, such as "Too expensive," "Do not like billing system," and/or "Do not like the service."

For each corresponding time on the x-axis, the likelihood that the phrase represented by a particular line was represented in one or more audio files recorded at the corresponding time may be plotted. In some implementations, one or more audio files may be investigated for particular set of key phrases and the corresponding plots may represent an aggregate confidence level of the presence of the corresponding phrase in the set of audio files. Additionally or alternatively, each line may represent a category of phrases and the plot for each time period may represent the likelihood that one or more phrases associated with the respective category is present in one or more of the investigated audio files at the corresponding time or time interval.

Call information area **1410** may display one or more pertinent characteristics of audio files used in a phrase search. In the illustrated interface, call information area **1410** includes a set of dates which may represent a time interval from which all audio files contained in a search were initially recorded. Channel type may describe the particular voice stream from an audio file which was utilized during a phrase search. For example a phone call between two callers may contain two channels: one for each speaker in the call. The user may select one or more channels contained in an audio file be used in a search with given key phrases. In some implementations, call information area **1410** may contain additional information regarding categories, terms, and/or search phrases which were used as parameters in a search of audio files. In some implementations, one or more components may be absent from call information area **1410** and/or additional components may be present.

Filter area **1405** may list one or more filters that have been utilized to filter one or more aspects of a search result from being included in trend chart **1420**. In the illustrated example, a filter is set to display a trend chart where each line represents a category. In some implementations, a filter may be activated which categorizes and displays phrases based on term groups of search terms and/or specific phrases as previously described. For example, a filter may be activated which displays search results where each line corresponds to a term contained within a specific category.

Graph selection area **1415** may display thumbnail versions of one or more additional and/or alternative displays for search result information. In some implementations, individual images in graph selection area may be smaller versions of more search result interfaces illustrated in FIGS. **12** through **15** and described herein. In one or more implementations, additional or alternative display options may be displayed in graph selection area **1415**, such as a pie graph. In some implementations, one or more images in graph selection area **1415** may be clickable and when activated, may direct the user to one or more additional and/or alternate display pages which may share one or more characteristics with the displays illustrated in FIGS. **12** through **15** and described herein.

In some embodiments, the bar graph **1220**, the word cloud **1320**, the trend chart **1420** may additionally and/or include emotion recognition information related to identifications in one or more audio files of a likely emotional quality of the voice of a speaker. In some implementations, a displayed confidence level displayed on a graph may be partially based on the likelihood that the speaker is experiencing the particular emotion. In some implementations, one or more markings on a graph may represent a particular emotion and the magnitude associated with the marking may represent the confidence level of the emotion. For example, a bar graph may represent categories of search phrases that were utilized in a search of a set of audio files. Each bar in the graph may represent an emotion, such as "Anger," "Impatience," and/or "Content." The height of bars in the bar graph may represent the number of calls00 where each emotion was identified, the likelihood that one or more emotions was identified in the set of audio files, and/or a cost associated with identified emotions. In some implementations, emotion recognition data may be represented on bar graph **1220**, word cloud **1320**, and/or trend chart **1420** with a different indication than the other displayed data such as, confidence level and/or cost measurements with set of phrases. For example, a word cloud may represent the number of calls with phrase matches associated with a category as previously described. The color of the words may correspond to one or more emotions, so that both confidence levels and emotions may be represented in the same graphic. The set of words "I would like to cancel my account" may be displayed in red, which may indicate that it is most likely that the caller is experiencing anger. The set of words "Upgrade my account" may be displayed in green, which may indicate that the speaker is experiencing satisfaction. The font size of the words may continue to represent the number of calls which matched each term.

Referring to FIG. **15**, aspects of an example audio file results graphical user interface display information regarding audio files that contain one or more identified key phrases which may be implemented in an embodiment of an audio file search engine is illustrated. For convenience, aspects of FIG. **15** will be described with reference to a system of one graphical interface. In some implementations, the graphical interface displaying the graphical user interface of FIG. **15** may share one or more aspects with workstation **270** as illustrated in FIG. **2** and described herein. The graphical user interface of FIG. **15** may be generated by a system which may share one or more characteristics and/or may include one or more components of the systems illustrated in FIGS. **1** and **2**.

Audio file list **1505** may include a listing of one or more audio files which were returned as a result of an audio file search. In some implementations, audio file list **1505** may be populated based on processes which share one or more steps and/or components with one or more methods as previously described and illustrated in FIGS. **2** through **7**. For example, a notification transmitted at step **430** of FIG. **4** and/or step **630** of FIG. **6** may trigger the population of audio file list **1505**. Additionally, for example, the event triggered at step **750** of FIG. **7** may include populating audio file list **1505**.

Entries in audio file list **1505** may include a filename **1510**, a time where a key phrase was located in an audio file **1515**, and a duration of an audio file **1520**. In some implementations, one or more entries in audio file list **1505** may not include one of these characteristics and/or may include additional characteristics. Additionally, the illustrated audio file entries include a checkmark box **1525**. Checkmark box **1525** may be activated by a user to select one or more entries for further analysis. For example, a user may activate checkmark box **1525** for two files listed in audio file list **1505**. After activating those two entries, a user may elect to save the contents of those files for later analysis.

Free style search box **1540** may allow a user to create a new search phrase. Free style search box **1540** may be utilized to enter a search phrase without accessing additional graphical user interfaces, such as the interfaces illustrated in FIGS. **12** through **14**. A phrase entered into freestyle search box **1540**

may be used as a search phrase in one or more audio files. In some implementations, a phrase in freestyle search box **1540** may be used on a listing of files in audio file list **1505**, entries in audio file list **1505** where respective checkboxes **1525** have been selected, and/or one or more alternate collections of audio files.

Confidence level box **1535** may display a confidence level which has been associated with one or more search terms. As described herein, the confidence level may take into account one or more identified characteristics such as, for example, associated costs, customer account information, and/or emotion recognition data. Additionally or alternatively, entries in confidence level box **1535** may be editable to allow a user to vary a confidence level with a particular word or phrase. In some implementations, confidence levels displayed in confidence level box **1535** may be based on results from a key phrase search of one or more audio files. In other implementations, confidence level box **1535** may be utilized by user to associate a particular confidence level with a search phrase. For example, a user may prefer to see all audio files in a set which contain the phrase "I'd like to cancel my account." The user may utilize confidence level box **1535** to set a low confidence level for that phrase. By lowering the confidence level, the search may return more results than what would have been returned with a higher confidence level, but the search is less likely to miss instances of the phrase.

Audio file visualization box **1555** may be used to display one or more aspects of an audio file. In some implementations, a visual representation of audio waves representing the audio file may be displayed in audio file visualization box **1555**. The x-axis of audio visualization box **1555** may represent a time interval in order to display one or more time periods of an audio file. For example, the left boundary of audio visualization box **1555** may represent the start of an audio file. Progression to the right of the audio visualization box **1555** may represent the progression of time in the displayed audio file. Additionally or alternatively, audio file visualization box **1555** may display one or more indications of potential matches to a given key phrase based on results of a key phrase search of an audio file. Bar **1560** and bar **1565** may be representations of locations in an audio file where matches have been located. Height of bar **1560** and **1565** may be representative of confidence levels that potential matches at positions in an audio file correspond to one or more search phrases. In some implementations, additional buttons may allow a user to playback an audio file recording, locate specific time periods in an audio file, and/or alter one or more aspects of an audio file. For example, the user may click on a bar in audio visualization box **1555** and may be provided with audio playback of the audio file at that time. The user may then audibly inspect the file to better determine whether the position in the audio file is a match to a given key phrase. In some implementations, audio visualization box **1555** may display an audio file listed in audio file list **1505**. A user may indicate a particular file to inspect, and audio visualization box **1555** may be populated with the audio file of interest.

In some implementations, search result information displayed in audio visualization box **1555** may be the result of using a single phrase to perform a search. In some implementations, the display may include identified matches to multiple phrases. For example, an audio file may be searched for all phrases associated with the category "Cancellation Reasons." The displayed search results in audio visualization box **1555** may have bars representing identified matches to any phrase in the category. Bars may be differentiated based on the particular identified phrase in a set of search phrases, such as color differences and/or labels on the bars. In some implementations, a user may click on a bar in audio visualization box **1555** and be directed to a display of data associated with the phrase that was represented by the bar. For example, clicking on a bar may direct a user to a display that lists the phrase that was identified, the cost associated with the phrase, the confidence level of the identification, and/or an audio clip at the time where the phrase was identified in the audio file.

Referring to FIG. **15**A, an example of an audio visualization box from an example graphical user interface for displaying audio search results is illustrated. Audio visualization box **1555**A may share one or more characteristics with audio visualization box **1555**. In the illustrated example, audio visualization box **1555**A displays phrase search results for an audio file. Time axis **1595**A is marked in increments of 10 seconds and may represent the time in a displayed audio file as previously described. In some implementations, time axis **1595**A may be marked with different time intervals and/or in different units. Phrase confidence axis **1570**A is marked as percent confidence that identified phrases in the displayed audio file search results match key phrases. Anger level axis **1580**A measures the likely emotion of the speaker on the displayed audio file based on a scale from 1 to 10. In some implementations, axes may be marked in different units and/or on different scales. For example, phrase confidence axis **1570**A may be marked in decimal values, anger level axis **1580**A may be marked based on one or more different emotions, and/or emotion data may be presented based on a confidence level of the identified emotion.

Bars in audio visualization box **1555**A may represent instances in an audio file where a phrase search identified a phrase at a corresponding time. The height of a bar may represent a value on phrase confidence axis **1570**A. For example, bar **1585**A is positioned at the 40-second mark on time axis **1595**A and has a height of 90% on phrase confidence axis **1570**A, which corresponds to an identified phrase 40 seconds into the audio file with 90% confidence that the phrase is present at that time. As another example, bar **1590**A displays an identified phrase at the 48-second mark with a height of 80% on confidence axis **1570**A. In some implementations, bars in audio visualization box **1555**A may not be present and/or additional bars may be included which represent one or more alternate of identifications in an audio file, such as emotion and/or cost.

Emotion line **1575**A represents an identified emotion of a speaker in an audio file on a scale from 1 to 10. In the illustrated example, emotion line **1575**A is a plot of an identified level of anger of a speaker. One or more additional and/or alternate lines may be present to represent additional emotions on the same graph. For example, a second line in audio visualization box **1555**A may represent instances where "impatience" is identified in the voice of a speaker. An emotion line **1575**A may be constructed by connecting data points where emotion is detected in the audio file. For example, a search may identify an anger level of 8 at the 10-second mark, followed by a level of 6 at the 15-second mark. The line between these points may show a trend that the speaker is less angry as the audio file progresses. In some implementations, emotion line **1575**A may be represented by a curved line based on a mathematical fit to the identified data points, such as a least squares fit.

In some implementations, a user may initiate one or more actions based on interacting with one or more elements of audio visualization box **1555**A. For example, a user may click on bar **1585**A and the audio surrounding that identified instance may be played so that the user may independently verify that the search phrase is present. In some implementations, clicking a position in an audio file may display addi-

tional information, such as a text transcript of the audio file, the identified emotion of the speaker, and/or information about the phrase identified at the time that was clicked. For example, audio visualization box **1555**A may display information regarding a category of phrases that were used in an audio search. By clicking on a bar, the user may be directed to a display which lists the phrase that was spoken at that time, the cost associated with that phrase, the confidence level of the match, and/or information regarding the customer who was speaking, such as account number, address, and/or account details.

While several inventive implementations have been described and illustrated herein, those of ordinary skill in the art will readily envision a variety of other means and/or structures for performing the function and/or obtaining the results and/or one or more of the advantages described herein, and each of such variations and/or modifications is deemed to be within the scope of the inventive implementations described herein. More generally, those skilled in the art will readily appreciate that all parameters, dimensions, materials, and configurations described herein are meant to be exemplary and that the actual parameters, dimensions, materials, and/or configurations will depend upon the specific application or applications for which the inventive teachings is/are used. Those skilled in the art will recognize, or be able to ascertain using no more than routine experimentation, many equivalents to the specific inventive implementations described herein. It is, therefore, to be understood that the foregoing implementations are presented by way of example only and that, within the scope of the appended claims and equivalents thereto, inventive implementations may be practiced otherwise than as specifically described and claimed. Inventive implementations of the present disclosure are directed to each individual feature, system, article, material, kit, and/or method described herein. In addition, any combination of two or more such features, systems, articles, materials, kits, and/or methods, if such features, systems, articles, materials, kits, and/or methods are not mutually inconsistent, is included within the inventive scope of the present disclosure.

All definitions, as defined and used herein, should be understood to control over vocabulary definitions, definitions in documents incorporated by reference, and/or ordinary meanings of the defined terms.

The indefinite articles "a" and "an," as used herein in the specification and in the claims, unless clearly indicated to the contrary, should be understood to mean "at least one."

The phrase "and/or," as used herein in the specification and in the claims, should be understood to mean "either or both" of the elements so conjoined, i.e., elements that are conjunctively present in some cases and disjunctively present in other cases. Multiple elements listed with "and/or" should be construed in the same fashion, i.e., "one or more" of the elements so conjoined. Other elements may optionally be present other than the elements specifically identified by the "and/or" clause, whether related or unrelated to those elements specifically identified. Thus, as a non-limiting example, a reference to "A and/or B", when used in conjunction with open-ended language such as "comprising" can refer, in one implementation, to A only (optionally including elements other than B); in another implementation, to B only (optionally including elements other than A); in yet another implementation, to both A and B (optionally including other elements); etc.

As used herein in the specification and in the claims, "or" should be understood to have the same meaning as "and/or" as defined above. For example, when separating items in a list, "or" or "and/or" shall be interpreted as being inclusive, i.e., the inclusion of at least one, but also including more than one, of a number or list of elements, and, optionally, additional unlisted items. Only terms clearly indicated to the contrary, such as "only one of" or "exactly one of," or, when used in the claims, "consisting of," will refer to the inclusion of exactly one element of a number or list of elements. In general, the term "or" as used herein shall only be interpreted as indicating exclusive alternatives (i.e. "one or the other but not both") when preceded by terms of exclusivity, such as "either," "one of," "only one of," or "exactly one of." "Consisting essentially of," when used in the claims, shall have its ordinary meaning as used in the field of patent law.

As used herein in the specification and in the claims, the phrase "at least one," in reference to a list of one or more elements, should be understood to mean at least one element selected from any one or more of the elements in the list of elements, but not necessarily including at least one of each and every element specifically listed within the list of elements and not excluding any combinations of elements in the list of elements. This definition also allows that elements may optionally be present other than the elements specifically identified within the list of elements to which the phrase "at least one" refers, whether related or unrelated to those elements specifically identified. Thus, as a non-limiting example, "at least one of A and B" (or, equivalently, "at least one of A or B," or, equivalently "at least one of A and/or B") can refer, in one implementation, to at least one, optionally including more than one, A, with no B present (and optionally including elements other than B); in another implementation, to at least one, optionally including more than one, B, with no A present (and optionally including elements other than A); in yet another implementation, to at least one, optionally including more than one, A, and at least one, optionally including more than one, B (and optionally including other elements); etc.

It should also be understood that, unless clearly indicated to the contrary, in any methods claimed herein that include more than one step or act, the order of the steps or acts of the method is not necessarily limited to the order in which the steps or acts of the method are recited.

In the claims, as well as in the specification above, all transitional phrases such as "comprising," "including," "carrying," "having," "containing," "involving," "holding," "composed of," and the like are to be understood to be open-ended, i.e., to mean including but not limited to. Only the transitional phrases "consisting of" and "consisting essentially of" shall be closed or semi-closed transitional phrases, respectively, as set forth in the United States Patent Office Manual of Patent Examining Procedures, Section 2111.03.

What is claimed is:

1. A computer implemented method of analyzing content originating from an audio source, comprising:

identifying an audio file, wherein said audio file is representative of spoken content of at least one speaker;

identifying a key phrase, wherein said key phrase includes one or more words of interest;

identifying a cost, wherein said cost is based on a value of either the presence of or the absence of said key phrase in said audio file;

identifying a candidate phrase in said audio file, wherein said candidate phrase is representative of one or more words spoken by said at least one speaker and present in said audio file;

associating a confidence level with said candidate phrase, wherein said confidence level is based on a probability that said candidate phrase matches said key phrase;

identifying a threshold confidence level;

determining whether said confidence level satisfies said threshold confidence level;

providing a notification when said confidence level satisfies said threshold confidence level, said notification providing an indication of the presence of said key phrase in said audio file;

wherein the providing of said notification is at least partially based on said cost; and

identifying a cost adjusting characteristic of said audio file; and

determining an adjusted cost, wherein said adjusted cost is an alteration of said cost and is based on determining said confidence level satisfies said threshold confidence level and identifying said cost adjusting characteristic of said audio file.

2. The method of claim **1**, further comprising the step of identifying a cost threshold, and wherein said notification is only provided when said cost satisfies said cost threshold.

3. The method of claim **1**, wherein said notification includes a candidate phrase location, wherein said candidate phrase location is indicative of a time in said audio file segment where said candidate phrase is located.

4. The method of claim **1**, further comprising the step of analyzing a second audio file for the presence of said key phrase utilizing said adjusted cost.

5. The method of claim **1**, wherein said cost adjusting characteristic is at least one of a customer importance level associated with said audio file, a customer service representative flag associated with said audio file, and a frequency of said key phrase in said audio file.

6. The method of claim **1**, wherein said at least one speaker includes a customer and a customer service representative, and wherein said audio file segment is indicative of a phone conversation between said customer and said customer service representative.

7. The method of claim **1**, wherein said method is executed on at least one central processor and at least one distributed processor.

8. The method of claim **7**, further comprising the steps of:

identifying, by said central processor, an audio file segment, wherein said audio file segment is a smaller portion of said audio file; and

providing said audio file segment to said distributed processor to perform at least the step of identifying said candidate phrase in said audio file.

9. The method of claim **8**, further comprising the steps of:

determining a computing load value necessary to achieve analysis of said audio file segment in real time; and

selecting a number of processors to utilize based on said computed load value.

10. The method of claim **1**, wherein said notification is only provided when said cost satisfies a cost threshold.

11. The method of claim **1**, wherein at least one of said confidence level and said threshold confidence level is based on said cost.

12. The method of claim **1**, wherein said notification provides an indication of said cost of said key phrase.

13. A computer implemented method of analyzing content originating from an audio source, comprising:

receiving an audio file, wherein said audio file is representative of spoken content of at least one speaker;

identifying a key phrase, wherein said key phrase includes one or more words which a user has interest in identifying in said audio file;

receiving a cost, wherein said cost is indicative of a value of either the presence of or the absence of said key phrase in said audio file;

identifying a candidate phrase in said audio file, wherein said candidate phrase is representative of one or more words spoken by said at least one speaker in said audio file and is a likely match for said key phrase;

identifying a threshold cost value;

determining whether said cost satisfies said threshold cost value;

providing a notification when said cost satisfies said threshold cost value, said notification providing an indication of the presence of said key phrase in said audio file; and

identifying a cost adjusting characteristic of said audio file; and

determining an adjusted cost, wherein said adjusted cost is an alteration of said cost and is based on determining said confidence level satisfies said threshold confidence level and identifying said cost adjusting characteristic of said audio file.

14. The method of claim **13**, wherein said cost is determined based on actual costs stemming from one or more previous audio files containing said key phrase.

15. The method of claim **13**, wherein said cost is determined based on one or more costs associated with text files containing said key phrase.

16. The method of claim **13**, wherein said notification provides an indication of said cost of said key phrase.

17. The method of claim **13**, wherein said notification is provided when said cost satisfies said threshold cost value and when a measure of likelihood of match between said key phrase and said candidate phrase satisfies a threshold confidence level.

18. A system, comprising:

a first analysis processor, said first analysis processor operable to execute instructions stored in memory, comprising instructions to:

receive a first audio file segment, wherein said first audio file segment is representative of spoken content of at least one speaker;

receive a key phrase, wherein said key phrase includes one or more words of interest;

identify a cost, wherein said cost is based on a value of either the presence of or the absence of said key phrase in an audio source;

identify a first candidate phrase in said audio file segment, wherein said first candidate phrase is representative of one or more words spoken by said at least one speaker and present in said audio file segment;

associate a first confidence level with said first candidate phrase, wherein said first confidence level is based on a probability that said first candidate phrase matches said key phrase;

identifying a first threshold confidence level;

determine whether said first confidence level satisfies said threshold confidence level;

provide a first notification when said first confidence level satisfies said first threshold confidence level, said first notification providing an indication of the presence of said key phrase in said audio file;

wherein the providing of said first notification is at least partially based on said cost; and

identify a cost adjusting characteristic of said audio file; and

determine an adjusted cost, wherein said adjusted cost is an alteration of said cost and is based on determining said confidence level satisfies said threshold confidence level and identifying said cost adjusting characteristic of said audio file.

19. The system of claim 18, further comprising:

a second analysis processor, said second analysis processor operable to execute instructions stored in memory, comprising instructions to:

receive a second audio file segment, wherein said second audio file segment is representative of spoken content of at least one speaker;

receive a key phrase, wherein said key phrase includes one or more words of interest;

identify a cost, wherein said cost is based on a value of either the presence of or the absence of said key phrase in an audio source;

identify a second candidate phrase in said audio file segment, wherein said second candidate phrase is representative of one or more words spoken by said at least one speaker and present in said audio file segment;

associate a second confidence level with said second candidate phrase, wherein said second confidence level is based on a probability that said second candidate phrase matches said key phrase;

identifying a second threshold confidence level;

determine whether said second confidence level satisfies said threshold confidence level; and

provide a second notification when said second confidence level satisfies said second threshold confidence level, said second notification providing an indication of the presence of said key phrase in said audio file;

wherein the providing of said second notification is at least partially based on said cost.

20. The system of claim 19, further comprising a central processor, said central processor operable to execute instructions stored in memory, comprising instructions to:

activate said first analysis processor and said second analysis processor based on a load value.

21. The system of claim 20, wherein said load value is based on density of a data stream from which said first audio file segment and said second audio file segment originated.

22. A computer implemented method of analyzing content originating from an audio source, comprising:

identifying an audio file, wherein said audio file is representative of spoken content of at least one speaker;

identifying a key phrase, wherein said key phrase includes one or more words of interest;

identifying a cost, wherein said cost is based on a value of either the presence of or the absence of said key phrase in said audio file;

identifying a candidate phrase in said audio file, wherein said candidate phrase is representative of one or more words spoken by said at least one speaker and present in said audio file;

associating a confidence level with said candidate phrase, wherein said confidence level is based on a probability that said candidate phrase matches said key phrase;

identifying a threshold confidence level;

determining whether said confidence level satisfies said threshold confidence level;

providing a notification when said confidence level satisfies said threshold confidence level, said notification providing an indication of the presence of said key phrase in said audio file;

identifying a cost adjusting characteristic of said audio file; and

determining an adjusted cost, wherein said adjusted cost is an alteration of said cost and is based on determining said confidence level satisfies said threshold confidence level and identifying said cost adjusting characteristic of said audio file

wherein the providing of said notification is at least partially based on said adjusted cost.

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